

**Biomass Research and Development  
Technical Advisory Committee**

**May 19–20, 2011**

***Meeting Summary***

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## List of Acronyms

Board – The Biomass Research and Development Board  
BRC – Bioenergy Research Centers  
BRDI – Biomass Research and Development Initiative  
CLS – Catalytic Conversion of Lignocellulosic Sugars  
Committee – Biomass Research and Development Technical Advisory Committee  
DOE – Department of Energy  
EISA – Energy Independence and Security Act  
EPA – U.S. Environmental Protection Agency  
EPACT – Energy Policy Act  
INL – Idaho National Laboratory  
LPO – Loans Program Office  
USDA – U.S. Department of Agriculture  
MYPP – Multi-Year Program Plan  
NEPA – National Environmental Policy Act  
NAREEE – National Agricultural Research, Extension, Education and Economics  
QTR – DOE Quadrennial Technology Review  
RFS – Renewable Fuel Standard  
RTI – Research Triangle Institute  
RES – Renewable Electricity Standard

## I. Purpose

On May 19–20, 2011, the Biomass Research and Development Technical Advisory Committee (Committee) held its second quarterly meeting of 2011. The purpose of the meeting was to discuss and receive updates about the recent activities of the U.S. Department of Energy (DOE) and U.S. Department of Agriculture (USDA). DOE representatives delivered presentations about the Biomass Program and Office of Science activities. USDA representatives delivered presentations about current agency activities, including the BioPreferred Program, USDA Regional biomass Research Centers, and the Biomass Research and Development Initiative (BRDI). The afternoon included a presentation from the U.S. Environmental Protection Agency (EPA) on the Renewable Fuel Standard and a panel discussion on catalyst-based conversion technologies. The Committee then broke out into subcommittees to continue discussing their 2011 recommendations. On the second day, Committee members received a National Agricultural Research, Extension, Education and Economics (NAREEE) update and listened to a pair of presentations on the DOE and USDA Loan Guarantee Programs.

See Attachment A for a list of meeting attendees. See Attachment B to review the meeting agenda. Meeting presentations can be viewed online at <http://biomassboard.gov/committee/meetings.html>.

**Background:** The Committee was established by the Biomass Research and Development (R&D) Act of 2000 (Biomass Act), which was repealed and replaced by Section 9008 of the Food, Conservation, and Energy Act of 2008. The Biomass R&D Board (Board) was established under the same legislation to coordinate activities across the federal agencies. The Committee is tasked with advising the Secretary of Energy and the Secretary of Agriculture on the direction of biomass research and development.

## II. U.S. Department of Energy Update

*Laura McCann, Biomass Program, U.S. Department of Energy*

Laura McCann opened the meeting with a welcome to new members of the Technical Advisory Committee. She discussed new membership selection criteria, changes to the nominating process and travel procedures, and new DOE and Biomass Program updates. Nominations for 2012 Committee members will begin in June 2011. Laura will be contacting current Committee members whose terms are ending this year to let them know if they are eligible for a second term.

She continued with updates on the recently completed DOE Quadrennial Technology Review (QTR). Alternative fuels are identified as one of the five primary focus areas, in addition to vehicle efficiency and electrification, building and industrial efficiency, Smart Grid, and alternative generation.

The Biomass Program has recently released an updated version of the Multi-Year Program Plan (MYPP). Major changes include 2010 updates for feedstock and conversion targets, updates to out-year design cases for biochemical and thermochemical/ gasification technology, the introduction of a uniform feedstock supply system approach, and updated volumetric potential and grower payments based on the update to the *Billion-Ton Study*.

Bob Ames asked about the delay in the release of the *U.S. Billion-Ton Update*, and Laura explained that it was taking longer than expected to move through the internal review process because of the potential policy implications of the report. She expressed hope that the report would be ready for presentation at Biomass 2011 (July 26–27, 2011) or for the August TAC meeting. Laura suggested that they schedule a presentation of the updated study for the August meeting, and members of the committee expressed an interest in such a presentation.

The next TAC meeting is scheduled to take place August 23–25, 2011. It will most likely be held in Illinois, at the University of Illinois-Urbana/Champaign, including tours of the miscanthus and switchgrass field trials at the university and a tour of ADM’s facilities in Decatur. The final TAC meeting for the year is scheduled to take place between November 7–10, 2011, and will most likely be held in the Washington, D.C. area.

### **III. US DOE Office of Science Update**

*Dr. Catherine Ronning, Office of Biological and Environmental Research, U.S. Department of Energy*

Dr. Catherine Ronning provided an overview of the DOE Office of Science and its commitment to biofuels as a sustainable energy resource. The office is planning for funding appropriations of \$405 million over five years for continued support of the three DOE Bioenergy Research Centers (BRCs) located throughout the United States. These projects are designed to focus on basic R&D and on high-risk/high-reward research. Highlights include the development of genetically modified switchgrass with 30% increased ethanol yields and inducing “super” ethanol tolerance in genetically altered yeast cells. Catherine also discussed other projects the DOE Office of Science has been involved with, including a joint USDA-DOE funding program for genomics-based research and a DOE Switchgrass Community Coordination Workshop, which was held January 18, 2011, in San Diego, California.

Bill Hagy asked about coordination with USDA research centers and ways that they could work together to avoid duplication. Catherine explained that Sharlene Weatherwax and other staff with the DOE Office of Science were in regular contact with USDA and had been invited to the opening of their new Biomass Research Centers.

William Provine asked about how the Office of Science fit into the DOE Quadrennial Review. Catherine stated that others in the Office of Science have been involved in the review process. Mr. Provine also asked about the future vision of the BRCs. The BRCs are currently up for renewal and have plans to play large roles in the development of biofuels in the near future.

Mark Maher and several committee members discussed the potential impacts of vehicle electrification as compared to that of biofuels. Laura McCann said that the DOE Vehicle Technologies Program had delivered a presentation on the subject at the December 2010 TAC meeting and said that she would distribute a copy of the presentation to the Committee.

## **IV. U.S. Department of Agriculture Update**

*Bill Hagy, Bioenergy Program, Rural Development, U.S. Department of Agriculture*

Bill Hagy delivered a presentation on recent updates to USDA's efforts to promote bioenergy. He discussed updates to the 2008 Farm Bill–Title IX programs, including the Biomass Crop Assistance Program, the Biorefinery Assistance Program, and the Rural Energy for America Program. The USDA Roadmap outlines a regionalized strategy for developing the nation's bioenergy resources. A key finding of the report is that meeting the EISA-RFS target of 36 billion gallons of biofuels by 2022 will require building 527 new biorefineries, with an investment of approximately \$168 billion. Of the 21 billion gallons of advanced biofuels mandated by EISA, USDA expects 14.6 billion gallons to be derived from dedicated energy crops, 4.6 billion gallons to come from agricultural residue, and 3.0 billion gallons to come from woody biomass. President Obama recently outlined his energy goals in a Blueprint for America's Energy Future, which includes a reduction of oil imports by one third by 2025 and initiating construction on four commercial scale advanced biorefineries over the next two years.

Todd Werpy pointed out that EIA projections don't assume that the country will meet the RFS targets in 2022 and suggested that future USDA studies include projections from other agencies, or that various government agencies coordinate their expectations and assumptions. Bill Hagy acknowledged that this was the case, but explained that the Secretary of Agriculture was trying to push biofuels development and that they were looking at the investments it would take to achieve legislative targets on biofuel production.

Steven Long asked about assumptions for the size and scale of the biorefineries that USDA expected would be built. Bill Hagy explained that they were looking at biorefineries in the range of about 40 million gallons per year. Although many new biorefineries can produce up to 100 million gallons per year, the Roadmap outlines an expectation that the cellulosic biorefineries of the future will be built at a smaller scale and located close to their feedstock source, in a 40–50-mile radius. Steven Long, Pamela Reilly Contag, Craig Kvien, and others engaged in a wide-ranging discussion on the pros and cons of that approach and the benefits and limitations to economies of scale.

## **V. Biomass Research and Development Initiative Solicitation Status**

*Carmela Bailey, National Institute of Food and Agriculture, U.S. Department of Agriculture*

Carmela Bailey delivered an update on the Biomass Research and Development Initiative's FY2010 awards. Eight awards totaling approximately \$47 million were awarded under the FY2010 joint DOE and USDA competitive solicitation. About 46% of the funding went to private companies, 47% to universities, and 7% to federal partners.

The FY2010 awards are as follows:

1. Cellana, LLC, Kailua Kona, HI \$5,521,173

Grant Purpose: To develop a biobased co-product, defatted biomass, as a protein food supplement by demonstrating its nutritional and economic value in livestock feeds. The algae will be characterized and the nutritional values of algal protein will be assessed to replace soybean meal and launch value-added algal protein supplements.

2. U.S. Forest Service, Rocky Mountain Research Station, Missoula, MT \$5,309,320  
Grant Purpose: To develop an integrated approach to investigate biomass feedstock production, logistics, conversion, distribution and end use centered on the use of advanced conversion technologies at existing forest industry facilities.
3. University of Kansas Center for Research, Lawrence KS; Irvine, CA \$5,635,858  
Grant Purpose: To demonstrate a novel green pilot-ready technology that diversifies the products to include advanced fuels, industrial chemicals, and chemical intermediates.
4. Exelus, Livingston, NJ \$5,185,004  
Grant Purpose: To develop energy crops with improved tolerance to drought and salt stress to enhance yields on marginal lands and a redesigned process utilizing new catalysts and process chemistry to produce hydrocarbon fuels without high temperatures and large energy inputs.
5. Domtar Paper Company, LLC, Ft Mill, SC \$7,000,000  
Grant Purpose: Three year project to build a semi-works demonstration plant using two technologies to convert low-value mill side streams and waste streams into higher-value sugar, tall oil, and lignin intermediates.
6. University of Kentucky, Lexington, KY \$6,932,786  
Grant Purpose: To improve biorefinery economics by using a systems approach from several disciplines, including plant and soil scientists, horticulturists, chemical engineers, and economists to convert biomass on-farm to butanol, ethanol, acetone, and organic acids.
7. University of Florida, Gainesville, FL \$5,430,439  
Grant Purpose: To demonstrate an improvement in the sustainability of sweet sorghum production and its processing efficiency. The university will identify traits associated with drought tolerance through genetic mapping, generate high-biomass sorghums with easily digestible stems and convert the bagasse to fermentable sugars.
8. Metabolix, Inc. MA, \$6,000,001  
Grant Purpose: To use metabolic engineering to enhance the yield of biobased products and fuels from switchgrass. They will couple thermal conversion to produce densified biomass and crotonic acid. The crotonic acid can be further processed to butanol, propylene, and other chemicals.

The FY2011 Solicitation was announced on April 15, 2011. Pre-applications were due on May 31, 2011, full applications invited on August 3, 2011, and award announcements are anticipated in early January 2012. Applicants must focus on the same technical areas as FY2010, with a new additional focus on the use of biodiesel in farming equipment and processing facilities. USDA will provide funding of up to \$25 million and DOE will provide funding of up to \$5 million.

William Provine asked a question about risk assessment and whether or not USDA had a risk threshold that was acceptable for project funding. Carmela Bailey explained that the projects were designed to be accomplished within four years and that most of the projects were thought to have a relatively low-risk profile. Carmela indicated that she thought the University of Kentucky project might have a higher risk, but that it was balanced out by other projects in the portfolio. Another question was asked about follow-up activities and evaluation, and Carmela explained that they have a very thorough evaluation process involving multi-state site visits and analysis, all of which are included in annual reports for the Secretary.

## **VI. BioPreferred Program**

*Ron Buckhalt, U.S. Department of Agriculture*

Ron Buckhalt delivered a presentation on the USDA BioPreferred Program. The Program was established by the 2002 Farm Bill to provide guidelines for certified biobased products. As a result of the 2008 Farm Bill and several Executive Orders, federal agencies are required to give procurement preference to certified biobased products. The federal procurement preference currently includes 64 product categories, representing more than 8,900 products in construction, vehicle maintenance, cleaning products, and other areas.

In addition, the USDA has also established a voluntary labeling system in which manufacturers can apply for a “USDA Certified Biobased” label. Since the launch of the voluntary labeling program in February 2011, over 1,000 applications have been received, more than 500 products have been certified, about 10% have failed, and the remainder is in a testing or review phase. Moving forward, USDA will be revising certain guidelines, determining qualifications for biobased “intermediate ingredients,” and evaluating other “complex assemblies.”

## **VII. USDA Regional Biomass Research Centers**

*Jeff Steiner, U.S. Department of Agriculture*

Jeff Steiner delivered a presentation on USDA Regional Biomass Research Centers. These centers leverage existing USDA nation-wide research capacity on sustainable biomass production and are designed to coordinate bioenergy R&D between the Agricultural Research Service and the Forest Service. The objectives of the centers are to:

- Increase biomass production efficiency to increase grower profits and reduce biorefinery transaction costs
- Optimally incorporate biomass and other dedicated feedstocks into existing agriculture and forestry-based systems
- Address the uncertainties of expanded production up-front to avoid negative impacts on existing markets and ecosystem services
- Develop and utilize new value-added coproducts to help enable commercially preferred biorefining technologies.

The President's recently released Interagency Working Group Report identified the breakdown of roles and responsibilities between DOE and USDA. DOE has primary responsibility for the development of new biofuel conversion technologies and basic long-term discovery science, while USDA has responsibility for the development and sustainable production and management of biomass feedstocks.

Steven Long asked about efforts to improve corn ethanol yields, and Jeff Steiner explained that corn ethanol was considered a mature technology and that the focus of USDA R&D efforts were on next generation fuels which would qualify as advanced biofuels under RFS2. Long and other members of the committee expressed their view that even though corn ethanol is a mature technology, that there were still considerable opportunities to improve yields and enhance the technology in a way that could produce significant benefits.

## **VIII. EPA Renewable Fuel Standard**

*Paul Argyropoulos, Environmental Protection Agency*

Paul Argyropoulos delivered a presentation on the outlook for the future of the National Renewable Fuels Standards Program. Paul discussed the differences between EPCA 2005-RFS1 and EISA 2007 RFS2, and outlined the volumetric requirements and obligating mechanisms under the new program, which has been in effect since July 1, 2010. Under the RFS program, renewable fuels are required to meet lifecycle greenhouse gas (GHG) emissions as modeled by the EPA for each feedstock and fuel conversion pathway. Indirect land-use changes (ILUC) are taken into account, but the EPA acknowledges the uncertainty surrounding these models and is prepared to revise its calculations for ILUC as the scientific consensus evolves.

The 2011 RFS Rulemaking revised the volumetric requirements for cellulosic biofuels from the 250 million gallons originally targeted, down to 6.6 million gallons. EPA is authorized to revise RFS obligated volumetric requirements, and releases its decision each November, based on market conditions and available production volumes. Although the EPA can reduce total renewable fuel and total advanced volumetric requirements in parallel with cellulosic biofuel reductions, the 2011 Rulemaking maintains the total advanced and renewable biofuel volumes at the original RFS2 targets. By 2022, the RFS Program is expected to reduce GHG emissions by 138 million tons, displace 7% of gasoline and diesel consumption, and increase net farm income by \$13 billion.

William Provine asked why the EPA was not being more aggressive in pushing Cellulosic Biofuels and why it was willing to back down so significantly from the original RFS2 targeted volumes. Paul Argyropoulos responded that EPA was as aggressive as possible on this front, but that they were required to work within the confines of EISA. Paul stated that the EPA was doing everything it was authorized to do. Mark Maher asked about the outlook for the ethanol market and the impact of the E10 blend wall. Paul confirmed that the EPA was confident that the RFS mandates for renewable biofuels could continue to be met. He explained that the EPA was examining other routes for renewable biofuels

to be integrated into the market, including through the use of E85, the impact of the E15 waiver, and pathways for renewable jet fuel, butanol, and renewable gasoline and diesel fuel.

## **IX. Catalyst-based Conversion Technologies Panel**

*Robert Brown, Iowa State University*

*Paul Blommel, Virent Energy Systems*

*David Dayton, Research Triangle Institute*

*James Rekoske, UOP-Honeywell*

Robert Brown, Paul Blommel, David Dayton, and James Rekoske delivered presentations on the status of catalyst-based conversion technologies, current challenges and opportunities, and their views on the appropriate focus of federal R&D efforts. After all of the presentations had been delivered, the four scientists took questions as a panel and led the committee in a discussion on this promising area of research.

Robert Brown provided an overview of various conversion pathways and economics and focused on the potential for thermochemical intermediates. He detailed various upgrading processes including hydrotreating, cracking, condensation, and oligomerization and highlighted the advantages of “drop-in” biofuels. He discussed renewable crudes, including syngas, bio-oil, and solubilized carbohydrates, and outlined a vision of future conversion pathways for upgrading bio-oil.

James Rekoske delivered a presentation on pyrolysis oil upgrading and catalysis for the direct liquefaction of biomass. Challenges for the upgrading of pyrolysis oil include contiguous carbon chain length in biomass, carbon efficient condensation chemistry, and ways to avoid polymerization. For the direct liquefaction of biomass, James identified other challenges, such as viscosity, stable catalyst systems, capital efficiency, and the generation of hydrogen. James discussed the approaches of Shell and the Pacific Northwest National Laboratory and the various characteristics of fast pyrolysis bio-oil versus hydrothermal bio-oil.

David Dayton delivered a presentation focused on catalytic pyrolysis and syngas cleanup. David provided background information on the Research Triangle Institute (RTI), the institution’s core competencies, and its approach to complex technical research. He outlined the stages for biomass gasification, syngas clean-up, and utilization. RTI has just initiated integrated testing of its tar cracking reactor and is beginning to analyze the results. David also discussed RTI’s bench-scale pyrolysis system, which utilizes a vapor phase upgrading approach. From this research, RTI has drawn conclusions about the impact of temperature on gas and water yields, as well as coke deposits.

Finally, Paul Blommel delivered a presentation on carbohydrates to hydrocarbons, and the challenges involved in commercialization and scale-up. Paul discussed the challenges involved in the generation of hydrocarbons from carbohydrates with in-situ hydrogen generation. Virent’s approach is feedstock flexible and uses inorganic catalysts, under moderate conditions, with low residence times and low energy separation to produce infrastructure compatible fuels and products on a tunable platform. Paul

discussed the characteristics of bioformed green gasoline and charted the similarities with unleaded petroleum gasoline. Catalytic processing can be used to replace a variety of products in addition to transportation fuels. Bioreformates can replace typical reformates, which are the dominant feedstocks for many chemicals, fibers, and plastics in use today. Paul discussed challenges for technology scale-up and Virent's partnership with the National Advanced Biofuels Consortium, including its leadership of the Catalytic Conversion of Lignocellulosic Sugars (CLS) strategy group.

Following these presentations, the panel engaged in a wide-ranging discussion with members of the Committee about the advantages of different conversion pathways, economics, and policy drivers. William Provine asked the panel to identify the major cost challenges in the pathways discussed. David Dayton identified syngas clean up as a significant cost issue, at about one quarter of the cost of unit operations and other panel members discussed different technical cost challenges and potential solutions involving the conversion process. Robert Brown identified feedstock costs as a major driver for project economics. Many of the panelists agreed that they were looking at cost ranges of \$2.60–\$3.20 per gallon, given feedstock costs at about \$75–\$90 per ton. For biocrudes, James Rekoske stated that he was looking at a price of around \$70–\$80 per barrel.

In response to a question about off-take agreements, James Rekoske stated that pyrolysis oil from UOP-Honeywell's IBR project in Hawaii was the subject of a bidding war between Chevron and other companies that were interested in purchasing their pyrolysis oil and that they were eager to increase their production volumes to meet demand. Harrison Dillon asked about the feedstocks used in the Hawaii project, and James related that it was a mix of feedstocks, including eucalyptus, sugar cane bagasse, and macadamia shells, and that they were considering any feedstock which could be provided at a reasonable scale.

## **X. Public Comment Period**

*Robert Beauregard, American Public Gas Association*

During the public comment period, Robert Beauregard delivered a presentation on the potential benefits of renewable biogas. Methane can be produced from digesters at waste water treatment facilities, food processing sites, landfills, large composting facilities, or from animal manure on farms. Biogas from any of these sites can be cleaned up and distributed through the existing natural gas pipeline system. The American Public Gas Association (APGA) envisions an extensive new pipeline system to capture biogas at locations throughout the country and integrate it into existing distribution systems to provide new clean sources of renewable energy. APGA believes that policy parity is needed to bring about these changes and that biogas should be provided with the same incentives as renewable fuels and other forms of renewable energy.

Mr. Beauregard requested that the following responses to questions raised by the Committee be included in the record:

R&D needs for renewable biogas:

- Allocate some portion of the Renewables Program area funding to support the demonstration of a renewable natural gas production facility utilizing gasification to produce pipeline quality gas from woody biomass and/or other materials including crop residues and wastes (Excellent efficiency—low emissions, carbon sequestration ready).
- Allocate funding to support further development of natural gas clean-up technologies focused on reducing cost and footprint.

Policy needs for renewable biogas:

- Parity among renewable credits—currently the production of renewable biogas gets nothing.
- If a national Renewable Electricity Standard (RES) is considered, ensure delivery of renewable biogas through existing interstate and intrastate pipeline systems delivered to an electricity generation site is an eligible means for covered electricity generators to produce renewable electrons to meet the RES.
- If a national carbon regime is developed that covers all fossil fuels, ensure renewable biogas utilized and delivered to consumers is not covered under the regime.

Follow up from Robert Beauregard, American Public Gas Association during Public Comment:

*Robert Beauregard was asked by a Committee member what R&D he would suggest in the Renewable Biogas area. He told the Committee he would seek more detailed input and report back. He collaborated with the Gas Technology Institute and the APGA Research Foundation and replied with the following response:*

*R&D needs for renewable biogas*

- *Allocate some portion of the Renewables Program area funding to support the demonstration of a renewable natural gas production facility utilizing gasification to produce pipeline quality gas from woody biomass and/or other materials including crop residues and wastes (Excellent efficiency—low emissions, carbon sequestration ready)*
- *Allocate funding to support further development of natural gas clean-up technologies focused on reducing cost and footprint.*

*Policy needs for renewable biogas*

- *Parity among renewable credits—currently the production of renewable biogas gets nothing.*
- *If a national Renewable Electricity Standard (RES) is considered, ensure delivery of renewable biogas through existing interstate and intrastate pipeline systems delivered to an electricity generation site is an eligible means for covered electricity generators to produce renewable electrons to meet the RES.*
- *If a national carbon regime is developed that covers all fossil fuels, ensure renewable biogas utilized and delivered to consumers is not covered under the regime.*

## **XI. NAREEE Update**

*Carol Keiser-Long, NAREEE Committee Chair*

Carol Keiser-Long delivered an update from the NAREEE Renewable Energy Committee. She provided an overview of recent NAREEE commitment discussions, including regionalization approaches, accountability of resources, and life-cycle assessments, and outlined major new directions and priorities for the Committee, such as feedstock development, production systems, and integration into existing agricultural systems. The committee is focused on new strategic approaches to enhance partnerships, develop quantitative measures of success, and promote multi-disciplinary research, education, and workforce development activities along the entire bioenergy supply chain. The next NAREEE Renewable Energy Committee meeting was held on July 14, 2011 in Washington, D.C. All of the TAC members were invited to attend.

## **XII. DOE and USDA Loan Guarantee Programs**

*Valri Lightner, U.S. Department of Energy*

*Kelley Oehler, U.S. Department of Agriculture*

Valri Lightner and Kelley Oehler delivered presentations on the DOE and USDA Loan Guarantee Programs for the construction of demonstration- and commercial-scale biorefineries. The Loan Guarantee Programs are designed to accelerate the deployment of new or significantly improved clean energy technologies by providing loans or loan guarantees to projects which have difficulty obtaining private financing because of high capital requirements and technology risks associated with first-of-a-kind technologies.

Valri discussed the multi-step review and approval process, including technical and financial evaluations, market due diligence, National Environmental Policy Act (NEPA) screening and compliance, and credit analysis. So far the DOE Loan Guarantee Program has only announced one award, which went to Diamond Green Diesel, for the construction of a renewable diesel biorefinery in Norco, Louisiana. The facility will have a nominal production capacity of 137 million gallons of renewable diesel and will produce valuable coproducts including propane, naphtha, and butane. It will be located adjacent to a Valero petroleum refinery and will take advantage of the existing supply chain infrastructure in the region. The DOE Loans Program Office (LPO) administers three clean energy loan programs and have provided loans or loan guarantees of over \$20 billion for 23 clean energy projects. Together, these projects created or saved almost 20,000 jobs and will avoid producing approximately 20 million tons of CO<sub>2</sub> each year.

Kelley Oehler provided an overview of the USDA Loan Guarantee Program and similarities and differences between the DOE and USDA programs. The USDA can provide loan guarantees of up to 80% if the loan is for less than \$150 million, up to 70% if the loan is for between \$150–\$200 million, and up to 60% for loans over \$200 million. The USDA has a maximum loan amount of \$250 million. “First-of-its-kind” applications currently in progress with USDA include \$54.5 million for Sapphire Energy, \$75 million

for INEOS New Plant bioenergy, \$80 million for Enerkem Corporation, \$12.85 million for Freemont Community Digester, and \$250 million for Coskata. Kelley also provided detailed information on eligible lender and borrower qualifications, terms and conditions, renewal fees and interest rates, and details of the application process.

William Provine asked about the timeline for applicants to move through the review process and the costs involved for these companies. Valri explained that the current timeframe was over a year, but that DOE was trying to streamline the process to around 9 months. Costs vary, but it would not be unlikely for a company to spend around \$1 million getting all of the detailed technical, legal, and market reviews of the application in place. Steven Long asked why national laboratories were included in USDA's list of eligible borrowers, and Kelley responded that they had not received applications from any of the national laboratories thus far, but that national labs were eligible to apply, perhaps as part of a consortium. Another question was asked about why there were two separate federal loan programs. Valri and Kelley explained that there was different authorizing legislation and that while the USDA program was strictly focused on biofuels, the DOE program provided loans to other types of energy projects. The program was originally focused on nuclear energy, and has expanded to wind, solar, and other projects. Of the 23 projects DOE is supporting with loan guarantees, only one is for biofuels.

#### Updates:

- Diamond Green Diesel withdrew from the DOE loan program at the end of May.
- DOE made a conditional commitment in July to Poet and to Abengoa in August.

### **XIII. Subcommittee Breakout Summaries**

#### **Feedstocks:**

##### **Needs:**

- Funding mechanisms for long-term trials and to continue to take advantage of existing trials rather than restarting the trial process.
- Long-term measurement of GHGs from various and emerging feedstock. NEON? NSF.
- Evaluation on Agave crops (e.g. sisal) for semi-arid lands that do not compete with food crops.
- Critical Questions:
  - Is there a dataset on land use outside current agriculture that measures use to identify land that is underutilized? (Does it exist?)
  - Where is the land that can be used for second generation feedstocks? Include ownership details.

##### **Indirect Effects:**

- Analysis on the indirect effects across all fuel types, and include petroleum. Should include current and future fuel sources including fossil fuel oil (e.g., tar sands, deep sea oil).

**Indirect Land Use:**

- The Committee recognizes the current work underway and recommends that the current research continue to completion.

**Woody Biomass:**

- Need assessment on potential of cropping some full-grown forest in eastern forest.
  - Take into account carbon sequestration practices
  - Critical Questions:
    - Where will this be beneficial to overall GHG balance and local economies?
    - What management practices will be optimal in achieving these goals?
- Continue with current woody biomass projects and expand into new woody biomass types.

**Productivity:**

- Need to examine quarantine facilities and the process of importing germplasm for breeding purposes to improve productivity of energy crops.
- When native species have been bred as feedstocks, strategies should be employed to ensure that pollen does not reach wild communities of the same species.
- Research on new bioenergy feedstock to investigate their environmental impacts for future production.
- Investigate data requirements and relationships/applicability for biotech/transgenic energy crops to identify necessary data and opportunities for streamlined approval process.

**Algae and other organisms:**

- Techno-economic engineering analysis for algae including life-cycle assessments and environmental analysis.

**Improving Biomass Logistical Systems**

- Linking feedstocks to end uses is critical to determining the optimum system.
- System tools to prioritize effort and optimize logistics from harvest to delivery.

**Sustainability:****Environmental Sustainability:**

- Land and resource use
  - To support the maintenance of biodiversity and understand the impact of direct land-use issues, we recommend an effort to connect and utilize existing activities and those under development to identify the existing planted or plant species as native, wild, or cultivated as a base line indicator for direct land-use issues.
- Biodiversity
  - The sustainability subcommittee recommends that in light of the emphasis placed on maintaining biodiversity while balancing economic, health, and environmental considerations, that the results from a thorough review of past and ongoing genetic

studies be compiled to assess the cost and viability of producing and permitting any modified bioenergy crop in a similar manner to that of food crops. Does the cost basis for such an endeavor create a non-sustainable bioenergy crop?

- We further recommend that mechanisms be created for the delivery of existing data from evaluation of the impact (environmental and socioeconomic) of genetic modification of other plants, trees, and food crops be delivered to decision makers for the deductive evaluation of sustainable energy crops in terms of environmental encroachment and potential cost impact (either negative or positive) on public health issues.

#### **Economic Sustainability:**

- We recommend a comparative economic analysis for how other countries manage a sustainable renewable industry by using an economic systems approach to:
  - Capital allocation
  - Capital markets
  - Systems analysis
  - Comparative economic analysis.
- We recommend studies to examine the potential for any complementary programs between refineries and biorefineries/biobased products.
- We recommend that there be studies to explore how to match the timelines of Program decision making with R&D timelines and commercialization timelines to determine the “best in class” (robust and sustainable) template for bench to market implementation.

#### **Social Sustainability:**

- We will restate 2010
- Minimize GHG
- Avoid negative impacts on human health

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

- We recommend (as a cross-cutting issue with the feedstock subcommittee) that studies be performed to specifically address high-cost issues regarding bioenergy crops, studies are needed to define the appropriate tests to review genetic modification.
- Research on a “standard” for bioenergy crops separate from food crops.
- We removed the recommendation specific to beetle deadfall as feedstock and will leave that to the feedstock subcommittee.

#### **Infrastructure:**

- Discussed questions with mid-blend wavier impacts on ethanol blend vehicles.
- Discussed questions on drop-in fuels. Should we stop work on ethanol blends vehicle and move to drop-in only?
- Discussed issues with definitions. Need clarity so that everyone is using the same term and definition. What does advanced biofuels mean? What are drop-in fuels?

#### **Conversion:**

The Conversion Subcommittee developed steps to form more meaningful recommendations. They will first review the newly released DOE Biomass MYPP and other related planning documents. They will

then hold a conference call before the next TAC meeting to discuss what they found and develop more directed recommendations.

#### **XIV. Closing Comments**

*Steve Briggs, Co-Chair*

Steve Briggs closed the meeting.

## Attachment A: Committee Member Attendance – May 19–20, 2011 Meeting

<b>Co- Chairs</b>	<b>Affiliation</b>	<b>Attended?</b>
Steve Briggs		YES
<b>Members</b>	<b>Affiliation</b>	<b>Attended?</b>
Bob Ames	Tyson Foods	YES
William Berg	Dairyland Power	NO
David Bransby	Auburn University	NO
Pamela Reilly Contag	Cygnnet Biofuels	YES
Bruce Dale	Michigan State University	NO
Harrison Dillon	Solazyme	YES
Joseph Ecker	Salk Institute for Biological Studies	NO
Neal Gutterson	Mendel Biotechnology	NO
Dermot Hayes	Iowa State University	NO
Jennifer Holmgren	LanzaTech Limited	NO
Huey-Min Hwang	Jackson State University	NO
E. Alan Kennett	Gay & Robinson Sugar	NO
Kevin Kephart	South Dakota State University	YES
Craig Kvien	University of Georgia	YES
Jay Levenstein	FL Dept. of Ag. and Consumer Services	YES
Stephen Long	University of Illinois	YES
Mark Maher	General Motors	YES
Jim Matheson	Flagship Ventures	NO
Mary McBride	CoBank	YES
Maureen McCann	Purdue University	NO
David Nothmann	Arborgen	YES
Mitchell Peele	North Carolina Farm Bureau	NO
Michael Powelson	The Nature Conservancy	YES
William Provine	Dupont	YES
James Seiber	University of California	NO
J. Read Smith	Agricultural Energy Work Group	NO
John Tao	O-Innovation Advisors, LLC	NO
David Vander Griend	ICM	NO
Todd Werpy	Archer Daniels Midland Company	YES
Rodney Williamson	Iowa Corn Promotion Board	YES

**Total: 15 of 31 members attended**

## Attachment B: Agenda – May 19–20, 2011 Meeting

<u>Day 1: Technical Advisory Committee Meeting:</u>		<u>May 19, 2011</u>
8:00 am – 8:30 am	<i>Breakfast (to be provided for Committee)</i>	<i>Salon DE</i>
8:30 am – 9:00 am	SGE Ethics Training for New and Current Members <i>Tina Hymer, General Counsel, U.S. Department of Energy</i>	<i>Salon DE</i>
9:00 am – 9:15 am	Welcome <i>Co-Chair – Steve Briggs</i>	<i>Salon DE</i>
9:15 am – 9:35 am	Welcome New Committee Members <u>Presentation</u> : Committee Business and DOE Updates <i>Laura McCann, Biomass Program, U.S. Department of Energy</i>	
9:35 am – 10:00 am	<u>Presentation</u> US DOE Office of Science Update <i>Dr. Catherine Ronning, Office of Biological and Environmental Research, U.S. Department of Energy</i>	
10:00 am – 10:15 am	<i>Break</i>	
10:15 am - 10:30 am	<u>Presentation</u> : USDA Update on Biomass R&D Activities <i>Bill Hagy, Rural Development, U.S. Department of Agriculture</i>	
10:30 am – 10:45 am	<u>Presentation</u> : Biomass R&D Initiative Solicitation Status <i>Carmela Bailey, National Institute of Food and Agriculture, U.S. Department of Agriculture</i>	
10:45 am – 11:05 am	<u>Presentation</u> : BioPreferred Program <i>Ron Buckhalt, U.S. Department of Agriculture</i>	
11:05 am – 11:25 am	<u>Presentation</u> : USDA Regional Biomass Research Centers <i>Jeff Steiner, U.S. Department of Agriculture</i>	
11:25 pm – 12:15 pm	<i>Lunch (to be provided for Committee)</i>	<i>Salon DE</i>
12:15 am – 12:45 pm	<u>Presentation</u> : EPA Renewable Fuel Standard <i>Paul Argyropoulos, Environmental Protection Agency</i>	<i>Salon DE</i>
12:45 pm – 2:15 pm	<u>Panel</u> : Catalyst-based Conversion Technologies <ul style="list-style-type: none"> <li>• <i>Robert Brown, Iowa State University</i></li> <li>• <i>Paul Blommel, Virent Energy Systems</i></li> <li>• <i>David Dayton, Research Triangle Institute</i></li> <li>• <i>James Rekoske, UOP-Honeywell</i></li> </ul>	<i>Salon DE</i>
2:15 pm – 2:30 pm	Public Comment <i>Robert Beauregard, American Public Gas Association</i>	

2:30 pm – 3:45 pm	Breakout: Subcommittees <i>Feedstock Conversion</i>	<i>Boardroom Salon DE</i>
3:45 pm – 4:00 pm	<i>Break</i>	
4:00 pm – 5:30 pm	Breakout: Subcommittees <i>Infrastructure Sustainability</i>	<i>Boardroom Salon DE</i>

**Day 2: Technical Advisory Committee Meeting: May 20, 2011**

8:00 am – 8:30 am	<i>Breakfast (to be provided for Committee)</i>	<i>Salon DE</i>
8:30 am – 10:30 am	<u>Discussion:</u> Subcommittee Report Outs <i>Feedstocks, Conversion, Infrastructure, and Sustainability</i>	<i>Salon DE</i>
10:30 am – 10:45 am	<i>Break</i>	
10:45 am – 11:00 am	<u>Presentation:</u> NAREEE Update <i>Carol Keiser-Long, NAREEE Committee Chair</i>	
11:00 am – 11:45 am	<u>Presentation:</u> DOE and USDA Loan Guarantee Programs <i>Valri Lightner, U.S. Department of Energy Kelley Oehler, U.S. Department of Agriculture</i>	
11:45 am – 12:00 pm	Closing Comments <i>Co-Chair –Steve Briggs</i>	
12:00 pm – 1:00 pm	<i>Lunch (to be provided for Committee)</i> <u>Discussion:</u> Next Biomass TAC Meeting Agenda Topics	<i>Salon DE</i>
1:00 pm	Adjourn	