Biomass Research and Development

Technical Advisory Committee

August 23–24 2011

Meeting Summary

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List of Acronyms

ARPA-E – Advanced Research Projects Agency Energy
Biomass Act – Biomass R&D Act of 2000
BMP – Best management practices
Board – Biomass Research and Development Board
BRDI – Biomass Research and Development Initiative
Committee – Biomass Research and Development Technical Advisory Committee
DOE – U.S. Department of Energy
DOI – U.S. Department of the Interior
DOT – U.S. Department of Transportation
EPA – U.S. Environmental Protection Agency
FFVs – Flex fuel vehicles
FRAC – Forest Research Advisory Council
FY – Fiscal year
GHG – Greenhouse gas
GMO – Genetic modified organism
GREET – Greenhouse gases, Regulated Emissions, and Energy use in Transportation
INL – Idaho National Laboratory
KDF – Knowledge Discovery Framework
LCA – Life-Cycle Assessment
MOU – Memorandum of Understanding
NAREEE – National Agricultural Research, Extension, Education, and Economics
NREL – National Renewable Energy Laboratory
NSF – National Science Foundation
PDU – Process Demonstration Unit
PNNL – Pacific Northwest National Laboratory
RDD&D – Research, development, demonstration and deployment
USDA – U.S. Department of Agriculture

I. Purpose

On August 23–24, 2011, the Biomass Research and Development (R&D) Technical Advisory Committee (Committee) held its third 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).

On the first day of the meeting, DOE representatives delivered presentations about the Biomass Program and current DOE agency activities, such as the Biomass 2011 conference, the recent Memorandum of Understanding (MOU) with the Navy and USDA, and the Idaho National Laboratory (INL) feedstock workshops. USDA representatives delivered presentations on the National Bioenergy/Biofuels Action Plan and discussed the Rural Economic Jobs report. In addition, a representative from Oak Ridge National Laboratory (ORNL) provided an overview from its most recently published *Update to the Billion-Ton Study*, and presentations were given regarding genetic modified organism (GMO) regulations as they relate to bioenergy and the Forest Advisory Council. The afternoon included a presentation from Argonne National Laboratory on Greenhouse gases, Regulated Emissions, and Energy use in Transportation (GREET) Model Development. Shortly thereafter, the Committee broke out into subcommittees to discuss their 2011 recommendations. On the second day, a Committee member presented on the 'Top 10 Facts about Ethanol Blends,' describing some of the automobile industry's viewpoints.

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 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 Research and Development Board (Board) was established under the same legislation to coordinate activities across the federal agencies. The Committee is tasked with advising the Secretaries of Energy and Agriculture on the direction of biomass R&D.

II. Committee Business and DOE Updates

Elliott Levine, Biomass Program, U.S. Department of Energy

The Committee has instated a new Co-Chair, Ronnie Musgrove, to chair the Committee alongside Steve Briggs. The new DOE designated federal officer, Elliott Levine, presented an overview of the meeting, explaining that the key to the meeting is to produce recommendations for R&D project improvements in the United States. Mr. Levine highlighted recent events from the Biomass Program, including the Program Peer Reviews, the Biomass 2011 Conference, the INL Feedstocks Workshop, and the *Update to the Billion-Ton Study* (which was discussed in further detail later in the meeting). Throughout the last seven months, nine Peer Reviews meetings took place, and reviews from the meetings will be available for the public once they are finalized. The *Biomass 2011: Replace the Whole Barrel, Supply the Whole Market* event was a success and was attended by more than 600 participants and featured more than 100 speakers, including Secretary of Energy Steven Chu, Secretary of Agriculture Tom Vilsack, and Assistant Secretary of the Navy Jackalyne Pfannenstiel. The INL Feedstocks Workshop was a joint event

sponsored by the DOE's Biomass Program, Office of Science, and Advanced Research Projects Agency Energy (ARPA-E), with the purpose of demonstrating preconversion biomass densification to encourage industry partnerships. Mr. Levine also delivered a review of the Biomass R&D Initiative (BRDI) joint solicitation, pointing out that applicants must propose projects that integrate science and engineering research in all three of the technical areas of Feedstock Development, Biofuels and Biobased Products Development, and Biofuels Development Analysis.

On August 16, 2011, the Obama Administration announced an MOU between DOE, USDA, and the U.S. Navy. Mr. Levine outlined the goals of the MOU and cited the benefits of producing bioenergy for the military. The MOU supports $510 million to advanced drop-in biofuels and reflects the federal recognition of improving biofuel infrastructure. More details on the MOU can be found on DOE's website: http://energy.gov/articles/president-obama-announces-major-initiative-spur-biofuels-industry-and-enhance-america-s.

The DOE Office of Science Genomic Science Program has announced three recent awards. More information can be found on DOE Web pages: http://science.energy.gov/news/in-the-news/2011/07-07-11/ and http://energy.gov/articles/usda-and-doe-fund-10-research-projects-accelerate-bioenergy-crop-production-and-spur.

The National Advanced Biofuels Consortium is moving to Stage II of its funding process led by the National Renewable Energy Laboratory (NREL) and Pacific Northwest National Laboratory (PNNL) and is funded by $35 million from the American Recovery and Reinvestment Act. More details can be found on EERE's website: http://apps1.eere.energy.gov/news/progress_alerts.cfm/pa_id=597

The next Committee meeting will take place on November 8–9, 2011.

III. USDA Update on Biomass R&D Activities and National Bioenergy/Biomass Action Plan

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

Bill Hagy opened his presentation by listing website resources for the Navy/USDA/DOE MOU and the Rural Economic Jobs Report:

http://www.rurdev.usda.gov/SupportDocuments/DPASignedMOUEnergyNavyUSDA.pdf

http://www.whitehouse.gov/sites/default/files/jobs_economic_security_rural_america.pdf

Mr. Hagy's presentation focused on the 2008 Farm Bill Title IX, including updates and success stories. Section 9002 of Title IX promotes and designates biobased market products. More than 9,000 individual products in 64 product categories have been designated since the Farm Bill's inception.

Neal Gutterson asked what drives the certification process. Bill Hagy responded that there is a submittal process by government and volunteers that bring in products. A private lab certifies if the product is at

least 35% biobased. Mr. Hagy added that this is valuable in marketing products, and only about 20–30 have failed, while many have passed.

Stephen Long asked if the biomass needed to be nationally derived. Mr. Hagy directed Mr. Long to Ron Buckhalt, who is the USDA point of contact for these issues.

Mr. Hagy continued to discuss the Farm Bill and noted that NREL is USDA's partner in decision making. He mentions that the future of this program is still not known. To date, five awards have been made.

Section 9003 of the bill is the Biorefinery Assistance Program and includes applicants for assistance, such as Enerkem, Coskata, and Sapphire Energy in New Mexico, which should break ground this fall. Section 9004 of the bill is focused on biomass as a heat and power source.

Section 9005 of the Farm Bill states that the term advanced biofuels includes more than transportation fuels, it also includes pellets and methane gas. USDA reviews these applicants and gives them a percent of the amount of money depending on their individual volume of project in total volume. Mr. Hagy added that biodiesel is going to meet or pass its 8 billion barrel goal this year, and that biomass conversion and wind are largest in Section 9007, which is the Rural Energy for America Program. He continued to state that in the United States, there are currently 21 renewable energy pumps and about 8 million flex fuel vehicles, and these vehicles do not match up with the locations of fueling stations.

In Section 9011: Biomass Crop Assistance Program, the USDA supports the establishment and production of crops for conversion to bioenergy in project areas and to assist with the collection, harvest, storage, and transportation of eligible material for use in biomass conversion facilities. Mr. Hagy proceeded by providing an overview of the nine establishments that the program has identified.

Todd Werpy inquired about the land that is used for these projects: are they new plants, "Is the land already being used for crops?" Bill Hagy explained that these projects are on new land, that the selection process is sensitive to land type, and they don't take away from food producing croplands.

Jay Levenstein asked a question relating to the projects that are pelletizing their crops; he followed up to ask if there are any thoughts about how the pellets are used. Mr. Hagy replied stating that the president is concerned about exporting products and that one project in Savannah exports to Europe. Currently, there is no preference as to whether crops are used for national or international use, because both ways make profits in the United States.

Upon viewing the project descriptions, a discussion began addressing certification process that these projects underwent. Stephen Long, Pamela Reilly Contag and William Provine are interested in how these specific projects were chosen by NREL in technical and economic feasibility. It is agreed that at the next meeting in November it would be helpful to have someone present the details of the process. Neal Gutterson also mentioned that it would be beneficial to have someone at the November meeting discuss co-products.

Mr. Hagy continued presenting and described the Biofuel Action Plan, which is INL's first attempt to show government that the past goals are no longer just on ethanol, but now are interested in drop-in fuels. This report is broader and looks at how the environment has changed since 2008 and what the current challenges are. The report should be ready by February 2012.

William Provine began a discussion on the definition of a "drop-in fuel" because there is currently no official definition. Mr. Hagy replied that there will be a federal government definition, that drop-in fuels are not to be blended like ethanol, and that there is an emphasis on third-generation biofuels. Mark Maher of General Motors adds that the infrastructure subcommittee is in the process of working on a recommendation for the definition of "drop-in fuels" and that there will be different definitions for diesel, gasoline, and aviation. Bill Hagy added that the federal government is going to get advice from the Committee—and maybe from the public—before they release a definition because they want it to be more transparent.

Jay Levenstein asked if processing bioproducts fit in this program or another. Mr. Hagy responded by saying that the USDA has a large definition, and all biomass fits—even municipal solid wastes and algae. The Farm Bill says that any biomass material that is not corn based is involved.

Todd Werpy commented that if you look at biofuel technology, there is a large need for hydrogen, and the industry needs hydrogen for drop-in fuel production. He was curious as to how the USDA and other government agencies view natural gas as a source of hydrogen. Pamela Reilly Contag and John Tao agreed that there is a need for generating cheap hydrogen, and to-date, biomass initiatives have not been addressing this issue. Mr. Hagy mentioned that the USDA has not concentrated on hydrogen, but the President includes hydrogen in the new energy bill. Because hydrogen regulations are covered under the EPA, he suggested that an update from EPA could be beneficial.

Mr. Hagy concluded his presentation by discussing the Rural Economic Jobs Summit and other Rural Summit events. USDA is conducting public meetings to listen to the public on economic development challenges on rural America. He brought up the example of Hawaii, where 90% of their electricity is from diesel. USDA has been developing renewable services with Hawaii, and they are currently constructing a biodiesel plant to fuel the Pearl Harbor area and other establishments, with hopes to have a ten-million gallon per year biorefinery there. Hawaii has a lot of land that can raise energy crops, and while momentum came slow at first, it is now moving, and their goal is to produce drop-in fuels.

Harrison Dillon inquired about the bioenergy project in Hawaii and whether or not they import their feedstocks. Mr. Hagy responded stating that thinks they import some of it, but they have the resources of agricultural waste, papaya, and they are looking into algae.

Mark Maher asked about drop-in fuels and what the constraints on costs are. He followed with the question of whether drop-in fuels have to be driven to a cost level that is petroleum competitive. Mr. Hagy replied, stating that the bill is allowing for drop-in fuels to be purchased at a higher cost in order to jump start the industry.

IV. *Update to the Billion-Ton Study*

Laurence Eaton, Oak Ridge National Laboratory

Laurence Eaton delivered a presentation on the *Update to the Billion-Ton Study (BT2)*, which benefited from the help of many organizations and expert reviewers. Project review details can be found online on the Bioenergy Knowledge Discovery Framework (KDF) website (www.bioenergykdf.net)—an online collaboration and geospatial analysis toolkit that allows researchers, policymakers, and investors to explore and engage the latest bioenergy research. The comparison to the original *Billion-Ton Study* is that the *BT2* has finer resolution, such as detailed estimations of crop and forest residues, and also contains economic supply curves. The *BT2* model considers millions of data and assumes food crop consumption is addressed first—energy crops are planted only after food targets are met. Sustainability was a main focus in the report, and the model included the question of, "how much biomass must be left on the land to keep it sustainable?" A significant change in the *BT2* compared to the initial study is that forest and crop residue values were estimated to be lower, and energy crop values are now higher in the*BT2*.

Harrison Dillon asked if the baseline values of the study are a downside or a median, and Pamela Reilly Contag asked for an example of an assumption that would allow the lower values to jump to the higher values. Mr. Eaton explained that the baseline is based off of 'business-as-usual' scenarios, and the high yield is calculated from assuming a best-case scenario. Constraint relaxing, which results in farmers possibly removing more from their yield, is an example that separates the baseline and high-yield scenarios. Stephen Long is agreed with the*BT2* and stated that the high yields presented are very realistic and, the model results are common. Mr. Eaton added that the high-yield values are usually an underestimate.

Mr. Dillon also asked how the *BT2* considered climate condition variables, such as droughts. Bill Hagy questioned if the study takes disasters, such as beetle kill, into consideration, and he asked if the report includes Alaska and Hawaii. In the *BT2*, climate changes were not included, but instead each year of projection is a three-year average, and beetle kill and episodic events are included in the *BT2*. Mr. Eaton explained that the *BT2* only accounts for the contiguous United States and excludes Alaska and Hawaii. A public attendee asked what amount of soil loss is tolerated in the estimate. The question was answered, explaining that the *BT2* does not have sensitivity on soil loss, but in Chapter 4 of the report, there are some examples. Kevin Kephart acknowledged that private investment going into wheat is targeting opportunity, and Mr. Eaton agreed that these events may influence *BT2* outcomes, mentioning that farmers respond to higher prices when there are energy markets.

Mr. Eaton continued his presentation, explaining that forest residues include site restrictions of recoverability, such as slopes, and changes have occurred since 2009—some pulpwood is assumed in the *BT2*. Residues and thinnings are both included to make the supply curve of forest resources. He concluded by stating that in the later years, the assumptions show much greater energy crop production resources, and there is wide distribution of biomass across the United States. The Bioenergy KDF provides greater details about *BT2* methodology and also includes personalized modeling.

William Provine asked how the study is being used in government and industry, if it is being integrated with other studies, such as the DOE Biomass Program's Multi-Year Program Plan (MYPP), and what the average cost of biomass production is. Mr. Eaton explained that the *BT2* contains aggregate supply with varying prices, $40, $50, $60 etc. , Assumptions for the MYPP regarding policy, were made by looking at Energy Independence and Security Act (EISA) and EPA and used forest demand running models to predict fuel/power estimates. He also added that this study is not currently integrated with others, but that it is a great idea.

Maureen McCann was unsure as to why the original *Billion-Ton Study* addresses diminishing oil supply and varying oil prices, but the *BT2* does not. Pamela Reilly Contag asked if this work will drive initiatives; she noticed that on the West coast, especially in California, there are very few biomass sites for bioenergy potential, and she questioned what USDA and DOE are doing to drive the West coast in regard to biofuels. Mr. Hagy assured l Ms. Contag that the U.S. government is comparing the differences of U.S. crop potential and plant location, and Mr. Eaton agrees that this is something that DOE is working on as well.

Bruce Dale asked if the BT2 addresses double cropping or intercropping, as it allows farmers to move more residue. The study does not include this yet, but it is DOE's intention to do so in the future.

Mr. Dillon noticed that in the presentation the value was set at $60 per dry ton, and he would like to see the enormous variability in processing costs. Mr. Eaton agreed that there is variation across these feedstocks across every point in the supply chain, and the study excludes the price of land. They found that $50–$60 per dry ton is enough to encourage energy harvest; conversion efficiencies should be reflected in cost of farmers' contract market. In the future, the study may be able to reflect market values.

V. GMO Regulations

Part 1: GMO Regulations: Biofuels and Bioenergy Crops

Drew L. Kershen, University of Oklahoma

Drew Kershen presented to the Committee a presentation on genetically modified organisms (GMO) regulations from a law perspective. He expressed that the regulations on biofuel innovations are preventing the field from progressing. He presented past studies that found no hazards or risks that result from the methods of genetic modifications. Mr. Kershen stated that it is his belief that focus on risk should occur independently from the process—the product should be the focus, not the process. He suggested that the United States needs to rethink its policy and stop regulating science that has not shown any credible harm.

Neal Gutterson asked if there is anything unique about bioenergy crops or if the views are general to all genetic modification (GM). Mr. Kershen thinks that is a broader issue; except in biomass, there are a lot crops that aren't domesticated, so he thinks there might be more issues in bioenergy GM.

Pamela Reilly Contag and Joseph Ecker both agreed that it is the product that should be evaluated and not the process.

Part 2: GMO Regulations: Biotechnology Regulatory Overview

Michael Gregoire, APHIS-USDA (call in)

Michael Gregoire delivered a presentation from the Biotechnology Regulatory Services (BRS) of the USDA's Animal and Plant Health Inspection Service. The presentation addressed the BRS Mission: "To protect America's agriculture and the environment using a science-based regulatory framework that allows for the safe development of genetically engineered (GE) organisms." The BRS regulates genetically altered or produced organisms; organisms that could be a plant pest; pesticide use; toxic substances; and GE organisms in food and feed in regard to their importation, interstate movement, and release into the environment. The BRS usually knows details about plants, but if they don't, they require the applicant to supply the biology details of the organism. Mr. Gregoire then gave a brief overview of the application process, including petitions. He also added that there is no specific process for energy crops. Applications are considered on a case-to-case basis. Once risk is determined to be null, then it is allowed to go through.

More information on BRS regulations can be found at: http://www.aphis.usda.gov/biotechnology/index.shtml. Bioproducts that have completed regulatory review can be found at: http://usbiotechreg.nbii.gov

At the end of the presentation, Mr. Gregoire added that the BRS has heard a lot of sentiments expressed about the U.S. Regulations Department on GM crops, and there is debate on this. The U.S. Regulations Department proposed a revision to BRS regulations in 2008 and received a lot of revisions. Some commented that they are over-regulating, while others say that they are under regulating. Mr. Gregoire concluded that ultimately, this decision must be made by Congress, and they are attentive to it. Everyone is trying to improve the timeliness of approval processes by putting in more resources and identifying potential modifications. Congress' Agriculture Committees are interested in the time and cost of the process; they will likely change something in the next Farm Bill to address these issues.

James Seiber asked what Brazil and/or China do in terms of regulating—if they are more lax, and if the regulating is non-existent. Mr. Gregoire responded, noting that countries have a variety of systems. He is not personally knowledgeable of each of these regulatory systems, but he does know that in China they do research on the crops they grow there. China will not allow field trials in the country until they are approved by the United States, and then after U.S. approval, they go through the China approval process. Brazil has a system that is addressing biotech plants differently than the United States. In the U.S., there are no regulations that distinguish biocrops to other agriculture crops, and this is a challenge with bioenergy crops or perennial crops because the National Environmental Policy Act requires that they analyze the environmental impact, which may require a more extensive analysis.

VI. Forest Research Advisory Council

Masood Akhtar, Committee Chair

Masood Akhtar, President, Bioenergy Deployment Consortium, briefly presented to the Committee on the USDA Forest Research Advisory Council (FRAC). FRAC's members are mostly universities, with some federal employees and some members from non-governmental organizations and the private sector. Similar to the Committee, FRAC produces a report every year that is about a page or two and includes recommendations for the Secretary of Agriculture. FRAC also discusses biofuels, and Masood Akhtar mentioned that it could be good to combine FRAC discussions with the Biomass TAC meetings. He also added that it might be beneficial for someone to speak at a future TAC meeting from one of the three Bioenergy Research Centers funded by the DOE. Bruce Dale, a member of Wisconsin Bioenergy Center, agreed that a briefing would be of value to the Committee.

VII. GREET Model Development

Dr. Michael Wang, Argonne National Laboratory

Dr. Michael Wang, a scientist from the Center for Transportation Research at Argonne National Laboratory (ANL), provided the committee with an overview of the latest updates to the GREET model. The DOE has supported development of the GREET – Greenhouse-gases, Regulated Emissions, and Energy use in Transportation – model since 1995 and it has become a widely regarded analytical tool to estimate and compare energy use, greenhouse gas (GHG) emissions, and other pollutants across a variety of different energy sources and technology platforms.

The last version of the GREET model was released in August 2010 and a new version is expected to be released in September 2011. The new version will include analysis of land-use change GHG emissions from corn stover, switch grass, and miscanthus, pyrolysis based diesel and gasoline production from forest residues, algae based renewable diesel and gasoline, and cellulosic-based renewable aviation fuels. The new version will also examine other fuel pathways including shale gas and renewable natural gas from landfills and other sources.

Dr. Wang presented graphs demonstrating how calculations of GHG emissions from corn ethanol vary widely depending on process fuels and the technologies used, but that cellulosic ethanol consistently achieves large reductions in carbon emissions. He also highlighted the importance of analyzing the use of co-products and discussed some of the difficulties the developers had encountered in analyzing GHG emissions related to the use of bio-char from pyrolysis conversion. He also discussed limitations in the current model surrounding water consumption and use and its implications for calculating GHG emissions related to algal biofuels production.

In response to a question from Huey-Min Hwang about claims that biofuels have a net negative energy balance, Dr. Wang referred to a graph that showed different calculations and studies on this subject conducted over the past thirty years. The graph shows an overall upward trajectory in calculations of the

net energy balance of ethanol, including a positive balance in all the studies published since 2006. Neal Gutterson inquired about recent calculations for natural gas and comparisons between natural gas, renewable natural gas, and shale natural gas. Dr. Wang stated that renewable natural gas produces less GHG emissions than shale natural gas and that shale natural gas used in power generation produces more GHG emissions than coal.

More information about the GREET model can be found on ANL's website at: http://greet.es.anl.gov/.

VIII. Public Comment Period

Eric Sack, Assistant Professor of Perennial Grass Breeding at the University of Illinois

Eric Sack spoke briefly on behalf of the American Society of Agronomy, the Crop Science Society of America, and the Soil Science Society of America. His presentation outlined the importance for overcoming the challenges in biofuel production. He pointed out that diverse and perennial feedstocks are needed even within individual regions to limit production risks. His presentation expressed enthusiasms for biomass and biofuels and encouraged further work to fulfill the United States' energy use projections.

Following Mr. Sack's presentation, Todd Werpy added that we need to look at whole demand, meet food requirements, and make sure we can supplement the fuel side. Bill Hagy commented that the USDA refers to it as "Fuel and Food," and mentioned that one of the MOU requirements is that the land must be non-food source. USDA is very cognizant of this debate and associated sensitivities.

IX. Top 10 Facts about Ethanol Blends

Mark Maher, TAC Member

Mark Maher delivered a presentation entitled the "Top 10 Facts about Ethanol." During the course of his presentation, committee members provided inputs and asked questions as he discussed each item on the list. The full list is as follows:

10. Ethanol is not gasoline
9. Biofuels are in competition with other energy alternatives
8. Fuel economy follows fuel energy density
7. Today's E85 flex fuel vehicles (FFVs) are energy efficient
6. The industry needs a second-generation success story
5. Mid-level blend testing is complete
4. Owners' manuals rule
3. UL testing can be tough
2. Fuel specifications are important for all blends

1. FFVs must not be taken for granted.

In his presentation, Mark highlighted some of the important differences between ethanol and gasoline. The first difference is conductivity; E15 is 1,000,000 times more conductive than E0, which makes it more corrosive. Another difference is that gasoline's distillation curve is very smooth. With E85, all the ethanol comes off at once, which means a cold engine requires significantly more liquid to start. For example, a cold start could take 9–10 times more volume of ethanol compared to gasoline. Todd Werpy asked if there is a recommended blend to control these differences, and Mr. Maher explained that for distillation, E85 is the worst, and that the key point is that they were really talking about two different fuels.

Mr. Maher emphasized the impact of energy density on fuel economy, which is important because the auto industry reports to consumers on a fuel-efficiency basis and needs to account for energy density in the reporting. From an automaker's standpoint, there is a great deal of competition in fuels, some renewable and some not. Each sector does not consider the others, but some fuels have very distinct advantages. The new regulations are technology forcing toward electric vehicles, rather than biofuels.

On this point, various committee members participated in a wide-ranging discussion about electric vehicles versus biofuels. Mr. Maher described how electric vehicles benefit from the tank-to-wheel analysis that is incorporated in current regulations. Bruce Dale expressed his concerns about the limits to this kind of analysis and Stephen Long pointed out that if you include the upstream emissions, given current sources of electricity generation, biofuels produce fewer emissions than electric vehicles. Other committee members expressed concerns about how quickly the electricity grid could be "greened" and about the scale of the electricity supply that would be needed to meet additional demand from electric vehicles along with existing electricity demand. Mr. Maher agreed and emphasized that the rate of change for biofuels could be significantly faster than for the electric grid.

Mr. Maher also discussed the importance of a second-generation success story. William Provine asked He pointed out that the auto industry cannot market biofuels on the back of corn ethanol and that they need another big success story. Todd Werpy added that the biofuels industry agrees with this sentiment and the need to show that second-generation biofuels can be reliable and cost effective over the long term.

X. Subcommittee Breakout Summaries

CONVERSION RECOMMENDATIONS

1) **International technology**

- *Problem Statement:* DOE/USDA and the Merit Review Process lack a comprehensive database of conversion technologies and the technical focus of various universities, companies, and institutes.
- *Recommendation:* Conduct an assessment of innovative conversion technologies and incentives to accelerate technology deployment in order to assess the position of the United States relative to other countries and leverage promising technologies.
- *Recommendation:* DOE should maintain a domestic and global database that should be a resource for merit reviews and made available to the public to ensure that the federal government reduces redundancies and to guide content of future solicitations.

2) <u>Prescriptive solicitations</u>

- *Problem Statement:* Proscriptive solicitations can be too narrowly focused and limit the potential of promising new technologies.
- *Recommendation:* Solicitations should not exclude feedstock blending for conversion processes that can excel if they utilize multiple feedstocks in their development to reduce risks of introducing multiple new technologies (e.g., cellulosic sugars blended with traditional carbohydrate feedstocks).
- *Recommendation:* Solicitations should allow for as much flexibility as possible in biofuel output requirements. Solicitations focused on minimum biofuel output requirements for a new commercial biorefinery (100%, 51%, etc.) can be arbitrary and not economically viable for some technologies. Diversification and flexibility are often needed to make plants economically viable.

3) <u>Separations technologies</u>

- *Problem Statement:* There is a critical gap in the existing solicitations portfolio on separations technology. Improved separations technology can significantly reduce capital and operating requirements and life-cycle emissions.
- *Recommendation:* Conduct a review of the status of chemical and physical separations R&D, with the goal of identifying gaps and opportunities in product purification (e.g., alcohol and water).
    - R&D should focus on reducing capital expense, operating expense, energy intensity, etc. for separations technology.

4) <u>Scale of supply/conversion systems</u>

- *Problem Statement:* DOE solicitations often do not take into account variations in the optimal size range (energy, environment, and socioeconomic) for different technology pathways using different feedstocks.
- *Recommendation:* DOE (including the Loan Guarantee Program) should incorporate more flexibility in the size requirements for commercial plants.

- No technology can jump more than one scale, and work should progress in methodical scale increases; reflect on solicitation processes to ensure that projects have first demonstrated lab success before pilot then demonstration/commercial.
- Small-scale systems can be commercially viable and still generate profits. Any minimum-size requirements should be explained in the funding opportunity announcement (FOA).
- Biomass scale-up requirements are different than those for petroleum refineries and need to be better understood.

5) <u>Drop-in fuels – Definition</u>

- *Problem Statement:* Definitions for "drop-in fuels" are often not clearly identified.
- *Recommendation*: Develop a clear definition of the term "drop-in" fuels, and maintain consistency of usage.

6) <u>Drop-in fuels – R&D on H2 production</u>

- *Problem Statement:* Many technology platforms require hydrogen (H2). Research investment is needed to explore ways to produce H2 for conversion processes from biomass and incorporate scalability needs and cost reductions. (e.g., innovative membrane technologies and process intensification). In general, new methods are needed to chemically reduce biomass.
- *Recommendation:* Begin investment on potential opportunities to produce cost effective H2 for the catalytic upgrading of intermediates derived from thermochemical and biochemical processes for production of renewable drop-in fuels.

7) <u>Merit review</u>

- *Problem Statement:* The merit review process often suffers from a lack of technical industry perspectives on the challenges involved in commercial production and scale-up.
- *Recommendation:* Invite more private industry experts—particularly those with commercial scale-up experience—to participate in the merit review process (except for exploratory programs).

<u>FEEDSTOCK RECOMMENDATIONS</u>

1) <u>Productivity</u>

- *Problem Statement*: Maximizing efficiency or yield is critical to the introduction of bioenergy crops. To support genetic improvement, there is a need to continuously expand the genetic base. Importation of new germplasm is one mechanism to expand the genetic base. The current quarantine process is recognized as a bottleneck to importation.
- *Recommendation*: Potential pests, pathogens, and invasiveness associated with emerging bioenergy crops needs to be addressed by quarantines to achieve more efficient quarantine practices.

- *Recommendation:* Update procedures for collecting, treating, and evaluating plant accessions to minimize risks associated with germplasm introduction.

- *Problem Statement*: There is a need to develop optimal management practices for sustainable bioenergy crop production.
- *Recommendation*: Continue and expand upon fundamental agronomic and silvicultural research for dedicated/purpose-grown energy crops (woody and herbaceous).
- *Recommendation*: Conduct research on new bioenergy feedstocks to investigate production potential and assess potential environmental impacts of future production.
    - Examine impacts of feedstock production on wild communities.

2) <u>Long-Term Commitment</u>

- *Problem Statement*: The current three-year research funding cycle is inadequate to provide long-term assessment of emerging dedicated/purpose-grown energy crops (both woody and herbaceous). Five-year cycles or longer are needed to support R&D on the sustainability of long-term production of bioenergy crops.
- *Recommendation:* Per peer review evaluation, prioritize existing long-term trials rather than establishing new trials.
- *Recommendation:* Undertake long-term measurement of GHGs and ecosystem services from various emerging feedstocks. This should be performed through long-term horizon programs. These could be modeled after programs such as the National Ecological Observatory Network (NEON) at the National Science Foundation and USDA's Watershed Program. This will better inform life-cycle analysis models.
- *Recommendation*: Evaluate opportunities through field trials and tech-economic studies for biofuel crops in non-irrigated semi-arid lands.

3) <u>Improving Biomass Logistical Systems</u>

- *Problem Statement*: Feedstock production is very distributed and low density. Design and implementation of logistical systems that densify feedstocks and deliver to processing nodes are limiting factors to creating a lignocellulosic-based biofuels industry.
- *Recommendation:* Need well-developed logistical models to deliver feedstocks to processors in a cost-effective manner, including integration of national efforts.
- *Recommendation:* Develop densification systems and assess their energy efficiency.
- *Recommendation:* Linking feedstocks to end uses is critical to determining the optimum logistics system.
- *Recommendation:* Need research to evaluate the processes needed to increase the energy density of feedstocks and to determine impacts on chemical composition and conversion, including lignin separation and potential synergies between logistical operations and downstream conversion operations.

4) <u>Indirect Effects</u>

- *Problem Statement*: There are currently more stringent system boundaries applied for biofuels than competing types of transportation fuels.
- *Recommendation*: Perform analysis on the indirect effects across all fuel types, including petroleum. This analysis should include current and future fuel sources, including fossil fuels (e.g., tar sands and deep sea oil).

- *Recommendation*: The Committee recognizes the current work underway on indirect land use and recommends that the current research continue to completion.

5) <u>Access to Land Use Information</u>

- *Problem Statement*: Although there is substantial acreage that could be used for bioenergy production, effective decision making on use is impaired by insufficient information on current use patterns.
- *Recommendation*: Develop a dataset on land use that identifies land that can be used for bioenergy initiatives.

6) <u>Algae and Other Organisms</u>

- *Problem Statement*: The economic and environmental viability of photosynthetic algae is unknown. Water needs are a key concern for the viability of algae as a feedstock.
- *Recommendation*: Perform a techno-economic engineering and systems analysis for photosynthetic algae, including life-cycle assessment (LCA) and environmental analysis.

<u>INFRASTRUCTURE RECOMMENDATIONS</u>

1) <u>Drop-in Biofuel Timing and Viability</u>

- *Problem Statement:* First- and second-generation ethanol blend fuels provide immediate GHG and energy diversity benefits. Third-generation and later "drop-in" biofuels hold the promise of future GHG and energy diversity benefits in which we must continue to invest. Resolution of immediate implementation issues associated with first- and second-generation fuels is being deferred on the grounds that drop-in fuels will preclude the need to spend time, money, and effort to resolve those issues. Issues include vehicle and other end-use device fuel compatibility issues, distribution issues, and interaction with complex emission, fuel economy, and CO_2 regulations.
- *Recommendation:* Planning and analysis activities should be undertaken to compare the GHG and energy diversity benefits of near-term biofuel alternatives, such as ethanol versus longer term drop in fuel options. Consideration must include the transitional benefits and certainty of current alternatives that can progress over time. Pursuit of drop-in fuels as an avoidance mechanism for investment in first- and second-generation biofuel infrastructure must be supported by sound planning and analysis. This planning and analysis must include factors such as probability of drop-in fuel technological readiness, timing, investment, and product cost.
- *Recommendation:* An action plan should be established based upon the described planning and analysis activity to establish an immediate growth pathway for first- and second-generation biofuels along the EISA/RFS pathway. The action plan should be formulated across DOE, USDA, EPA, the National Highway Traffic Safety Administration, and industry to address and remove all roadblocks to growth. Industry partners must include fuel retailers, fuel distributors, fuel producers, and auto manufacturers.

2) **Drop-in Biofuel Definition and Specification**

- *Problem Statement:* There is no consistent and broadly recognized definition for drop-in fuels. Specific technical definitions for "drop-in" fuels are critical building blocks for research on the fuels themselves, as well as infrastructure issues and end-use adoption.
- *Recommendation:* Agencies are advised to engage in research, planning, and analysis activities to develop clear definitions for different categories of "drop-in" fuels, including:
  - Drop-in fuels for spark-ignited engines (gasoline engines)
  - Drop-in fuels for compression-ignition engines (diesel engines)
  - Drop-in fuels for jet-aviation engines
  - Drop-in fuels for Combined Heat and Power (CHP)
- *Recommendation:* Agencies are advised to engage in collaborative research with standard setting organizations, such as American Society for Testing and Materials, CRC, trade associations, and the military for end-use devices (Auto Alliance, Small Engine Manufacturers Association, American Petroleum Institute, Department of the Navy, etc.) as the definitions for drop-in fuels are developed. Consider comparable standard setting process for other industries, such as the pharmaceutical industry (for bio-similar products).

3) **Octane of Low and Mid-level Ethanol Blend Fuels**

- *Problem Statement:* The opportunity to raise the octane value of commercial gasoline-ethanol blend fuels has not been realized with the transition to E10 blend fuel in the United States.
- *Recommendation:* Agencies are advised to undertake planning and analysis to realize the tank-to-wheel efficiency potential of mid-level ethanol blend fuels by increasing the required octane rating of those blends. As certification fuels are adjusted to reflect ethanol blends found in the field, gasoline blend-stocks should be adjusted to allow the certification fuels to have higher octane characteristics. This would allow improved thermal efficiency and optimization of engine size (lower displacement and weight) over time as auto manufacturers take advantage of those fuel characteristics in new model designs. An increase in octane requirements increase for ethanol blend fuels can and should be pursued regardless of policies related to FFVs or ethanol-tolerant vehicles.

4) **Near Term Recommendations for Higher Blend Ethanol Fuel Use:**

- *Problem Statement:* Biofuel growth along the RFS trajectory is falling behind. Planning and analysis activities should be immediately undertaken in key areas to increase the compatibility of the car parc at a rate that can support growth along the RFS trajectory. Failing to take immediate action will result in lost energy independence opportunity and lost CO_2 reduction opportunity. Vehicle and fuel compatibility choices should be designed to account for the fuels that vehicles are most likely to see in the field (E10–E15), while enabling growth in ethanol concentration over time per the RFS, without durability or other

consumer dissatisfaction issues. Certification fuels should reflect field fuel realities with appropriate accommodation for energy density.

- *Recommendation:* Option 1 – Define and implement a new category of vehicles defined as Blend Optimized Ethanol Tolerant Vehicles.

  In light of EPA's approval of E15 for use in model 2001 vehicles and later, adopt the design of a regulatory framework for fuels that vehicles are likely to use, while accounting for planned increase in the amount of ethanol in gasoline-ethanol blend fuels over time per the RFS.

  Adopt certification fuels that reflect the field fuel waiver for 2001 and later vehicles, with adjustment for energy density; for example, E15 certification fuel for model year 2014 or later, with accompanying energy density adjustment (approximately 5%). Adjust certification fuel subsequently in five-year increments. For example, adjust certification fuel in 2019 to E20, with associated further energy density adjustment (approximately 6.5%).

  Adjust the vehicle certification protocol to require vehicle optimization on the defined mid blend certification fuel while requiring tolerance of ethanol blends ranging from E0 to E85 in vehicle design. Tolerance is here defined as the ability to operate on blends from E0 to E85 without damage to the vehicle or substantial loss in drivability/performance under defined operating conditions. Emission performance, diagnostics, and fuel economy would only be demonstrated in the certification process on the certification fuel blend itself (initially E15)—not on higher blends for which the vehicle is only designed to be tolerant. This would result in vehicles being optimized on the fuels they are more likely to see in the field without the cost of full FFV functionality. This would allow for the production of vehicles that are tolerant of a range of blends with that have greatly reduced interaction with emission and OBD (diagnostic) regulations.

- *Recommendation:* Option 2 – Pursue broader implementation of FFVs in the car parc thru incentive or mandate.

  Research, planning, and analysis should be undertaken on the barriers to harmonize FFV technology with new Tier 3/LEV 3 tailpipe/evaporative emission, CO_2, and onboard diagnostic (OBD) requirements administered by the EPA and the CARB in the U.S. Since new CO2 and fuel economy regulations are designed to be technology forcing toward electrification, auto manufacturers are unlikely to produce FFVs in high volume going forward without harmonization of the new standards with FFV certification requirements and protocols.

  Vehicles that are designed to work with varying blends have different regulatory interaction than vehicles designed to work with a single or small range of blends. The need for this accommodation is based on differences in the vapor pressure and boiling characteristics of low-level gasoline-ethanol blends and high-level gasoline-ethanol blends.

5) **Market Creation – Non-Vehicle End Use Devices**

- *Problem Statement:* The fuel-related capability of non-vehicle end-use devices must match that of vehicles with which they share fuel distribution infrastructure.
- *Recommendation:* Research should be undertaken to understand the design requirements of establishing a minimum biofuel blend capability in non-vehicle end -use devices (marine, outdoor power equipment, other). This should follow the EPA vehicle fuel waiver.

6) **Market Creation – Fuel Blends and Distribution**

- *Problem Statement:* Vehicles and other end-use devices will require different ethanol blend fuels over time due to legacy effects.
- *Recommendation:* Research should be undertaken to explore the barriers to implementing blender pumps that are capable of dispensing fuels to meet the design specification of all end use devices (vehicles, marine, outdoor power equipment) (specifically call out certification fuels in non-vehicle end use devices). Research should be undertaken to explore the potential benefits of implementing technology and conducting education and outreach to prevent mis-fueling of end-use devices within the flex fuel (blender) pump context. Planning and analysis should be undertaken to identify methods that successfully encourage consumer selection of the highest biofuel blend available to them. This study should include flex fuel (blender) pump configurations and consumer economic factors.

7) **Market Creation – Post Bio-Refinery Infrastructure**

- *Problem Statement:* Fuel distribution terminals and refueling stations must be configured to allow for efficient and air-quality-compliant delivery of ethanol and gasoline components in the blender pump context.
- *Recommendation:* Planning and analysis should be undertaken to establish the parameters of hydrocarbon fuel blend stock compatibility and feasible delivery/transportation mechanisms that could support the blender pump market model. This study must include fuel volatility compliance, tankage, and transportation issues.

USDA predictions are that biofuels production will be located mainly in the Southeast and East-Central regions. Major fuel markets are concentrated along the West and East coasts. The current transportation infrastructure is insufficient to accommodate the volumes of biofuels that will be produced. Research should be undertaken into the barriers and solutions of transporting biofuels from biorefineries to markets.

8) **Biopower vs. Liquid Alternative Transportation Fuels**

- *Problem Statement:* Biomass for electricity (pure biomass and co-firing with coal) vs. biomass for liquid transportation fuels must be explored. More planning and analysis should be focused on the relative value of using biomass to produce electricity versus liquid transportation fuels in the short, medium, and long term.

- *Recommendation:* Research should be undertaken on the infrastructure needs and regulatory barriers of biopower, including the optimal locations, scale of plants, and potential densification strategies and technologies. The influence of battery energy density in the short and medium term (significantly lower than the energy density that can be achieved from liquid fuel alternatives) must be factored into the analysis.

  Factors including timing, car parc impact, carbon intensity, rural development, magnitude of capital required for infrastructure investments along different technology pathways, and the energy requirements for heating/cooling vehicles (utility aspects) must be understood.

SUSTAINABILITY RECOMMENDATIONS

1) **Environmental Sustainability – Land and Resource Use**
   - *Problem Statement:* Converting existing land to alternative uses will be considered. The complete ecological impacts may not be covered in life-cycle analysis due to incomplete data on the current ecosystem. For example, baseline data on the existing plant system would be helpful for decision making to support the maintenance of biodiversity and the increase of biofuels production.
   - *Recommendation*: We recommend continuing the environmental assessment activity and those activities under development to analyze the current ecosystem as a baseline indicator for direct land-use issues. The analysis should be compared to other energy systems.

2) **Economic Sustainability**
   - *Problem Statement*: There are currently no good models for growth and economic analysis of a sustainable bioenergy industry
   - *Recommendation*: Using best-in-class analysis of both a successful and unsuccessful biofuels projects funded by the DOE and/or USDA with funding in excess of $25M, do an analysis to identify the risks and potential de-risking solutions in order to create a decision tree for those projects with the highest potential for success.
   - *Recommendation*: We recommend a comparative economic analysis of other countries' management of their sustainable, renewable industries by using an economic systems approach to complete the following:
     - Capital allocation
     - Capital markets
     - Systems analysis
     - Comparative economic analysis.

   - *Problem Statement*: Energy industry capital assets are currently under used.
   - *Recommendation*: We recommend studies to examine the potential to leverage existing capital assets to advance bioenergy and bioproduct production.

   - *Problem Statement*: Government and industry timelines with regards to research and commercialization are not aligned.

- *Recommendation*: 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" (most robust and sustainable) template for bench to market implementation.

3) <u>Economic, Environmental and Social Sustainability</u>

- *Problem Statement*: To expand the industry, we have to manage multiple social issues such as job creation, training, access, and infrastructure. Growth management issues need further study.
- *Recommendation*: A comprehensive study should be conducted on the potential social and economic impacts of the emergence of a biofuels, biopower, and biobased products economy. The study should:
  - Investigate the number and kinds of jobs created, the manpower required, the availability of manpower in rural areas, and the likelihood and size of population shifts from urban to rural areas
  - Estimate and project the consequential increase in demand for human infrastructure—especially in rural areas (e.g., housing, education, healthcare facilities, communication, and police and fire protection)
  - Estimate and project the consequential need for transportation infrastructure for both the movement of biomass and the movement of the increased population (e.g., roads, bridges, rail, highway, air service, power lines, natural gas, and fuel transmission)
  - Develop a comprehensive plan at the federal level and communicate anticipated needs to state governments and agencies which will bear the brunt of these changes.
  - The study should include research and analysis into the appropriate size of biomass-based businesses and industries for the economic, natural, and social resources in the area.
- *Recommendation*: We recommend studies to inform a plan to drive adoption of the bioeconomy (biofuels, bioproducts, and biopower). Further, the impacts, both positive and negative, of such changes on the current business community should be studied. Such a study should try to address such questions as:
  - How to maximize opportunities for rural economic development utilizing business and technology systems that encourage local ownership of biofuel, bioenergy, and bioproduct systems?
  - Will existing agricultural supply and agricultural processing be negatively impacted?
  - Will competition for labor increase wages in rural communities forcing some marginal businesses to close?

4) <u>Cross-cutting</u>

- *Problem Statement*: GMO regulation processes may make it too expensive to deploy some bioenergy crops.
- *Recommendation:* We recommend (as a cross-cutting issue with the feedstock subcommittee) that studies be performed to specifically address high-cost issues regarding bioenergy crop. Studies are needed to define the appropriate tests to review genetic modification and the differences in risks that exist between bacteria, algae, and higher plants.

- *Problem Statement:* Water quality and availability is emerging as a key issue in the growth of the bioeconomy.
- *Recommendation*: Water utilization in the production of biofuel crops and in the production of biofuels has gained additional scrutiny in recent years. Enhanced and integrated research should be conducted to better understand and compare water use regionally at all stages of biofuels production and ways in which to conserve water, and maintain water quality, throughout this lifecycle. The analysis should be compared to other energy systems.

- *Problem Statement*: Additional data needs to be developed to expand the ability of the LCA models to analyze and compare bioenergy systems.
- *Recommendation*: We recommend that the USDA and DOE institute a program to monitor and measure relevant environmental parameters for inclusion in the model that is used, especially the current and expected feedstocks for biofuels, biopower, and biobased products. These measurements should be made in different geographies and climates, and they should remain in place for at least five years to cover the impacts of weather and soil variability

- *Problem statement:* About five years ago, nearly $500 million dollars were awarded to large-scale commercialization projects for building cellulosic ethanol plants. These projects faced significant challenges that altered the path to success, but may have provided important lessons learned for future initiatives. The administration has recently announced a new initiative for large-scale production of "advanced drop-in biofuels." This subcommittee believes it is possible that this new program may face many of the same challenges, and the success of this drop-in biofuel project would benefit by understanding some of issues and their solutions that were part of the experience of the cellulosic commercialization initiative.
- *Recommendation:* We recommend a careful study of the challenges and solutions (if any) of the cellulosic ethanol plants before awarding large amounts of money for drop in advanced biofuels. These "lessons learned" should shape the criteria in the Request for Proposals (RFP) under which competing projects will be selected. Based previous experience, these criteria might include; a more in depth knowledge of the feedstock biology, harvesting and storage challenges, scale of the potential feedstock, prior validation of the key technologies at an appropriate scale and an experienced management team. The statement of criteria ought to be sufficiently rigorous so that the administering agencies would be in a position to make no awards if the criteria were not satisfied.

XI. 2011 Work Plan and Future Biomass Committee Meeting Agenda Topics

Elliot Levine

Elliott Levine asked Committee members to discuss what topics, speakers, and/or organizations they would like to address the Committee in future meetings. Some topics include the following:

- Oil refiners' perspectives on the incorporation of biofuels into the fuel mix (feedstocks, blending)

- What are the tradeoffs with Vehicle Electrification?
- A detailed presentation on the current solicitation process and an opportunity to evaluate the current process and make recommendations to the Board prior to next year's solicitation preparation and publication
- A detailed presentation on the current USDA and DOE loan guarantee solicitation processes and application processing
- A presentation on the application procedures for the Biomass Crop Assistance Program (BCAP) and a more detailed discussion on how BCAP projects are selected
- A presentation outlining the results of past investments—both successful and non-successful—including any lessons learned as result of these past awards that might assist in the future direction of the Section 9008 program.

XII. Closing Comments

Elliot Levine

Elliot Levine closed the meeting.

Attachment A: Committee Member Attendance – August 23–24, 2011 Meeting

Co- Chairs	Affiliation	Attended?
Steve Briggs		NO
Ronnie Musgrove		YES

Members	Affiliation	Attended?
Bob Ames	Tyson Foods	NO
William Berg	Dairyland Power	YES
David Bransby	Auburn University	YES
Pamela Reilly Contag	Cygnet Biofuels	YES
Bruce Dale	Michigan State University	YES
Harrison Dillon	Solazyme	YES
Joseph Ecker	Salk Institute for Biological Studies	YES
Neal Gutterson	Mendel Biotechnology	YES
Dermot Hayes	Iowa State University	NO
Jennifer Holmgren	LanzaTech Limited	NO
Huey-Min Hwang	Jackson State University	YES
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	NO
Maureen McCann	Purdue University	YES
David Nothmann	Arborgen	YES
Mitchell Peele	North Carolina Farm Bureau	YES
Michael Powelson	The Nature Conservancy	NO
William Provine	Dupont	YES
James Seiber	University of California	YES
J. Read Smith	Agricultural Energy Work Group	NO
John Tao	O-Innovation Advisors, LLC	YES
David Vander Griend	ICM	NO
Todd Werpy	Archer Daniels Midland Company	YES
Rodney Williamson	Iowa Corn Promotion Board	NO

Total: 21 of 31 members attended

Attachment B: Agenda – August 23–24 Meeting

Day 1: Technical Advisory Committee Meeting: August 23, 2011

7:00 am – 7:30 am	*Breakfast (to be provided for Committee)*
7:30 am – 8:15 am	Welcome and Introductions *Co-Chair – Steve Briggs* *New Co-Chair Introduction – Ronnie Musgrove* *New DOE Designated Federal Officer – Elliott Levine* *New Committee Member Introductions*
8:15 am – 8:45 am	Presentation: Commitee Business and DOE Updates *Elliott Levine, Biomass Program, U.S. Department of Energy*
8:45 am – 9:45 am	Presentation: USDA Update on Biomass R&D Activities and National Bioenergy/Biomass Action Plan *Bill Hagy, Rural Development, U.S. Department of Agriculture*
9:45 am – 10:00 am	*Break*
10:00 am - 10:45 am	Presentation: Updates to the Billion-Ton Study *Laurence Eaton, Oak Ridge National Laboratory*
10:45 am – 11:45 pm	Presentations: GMO Regulations *Drew L. Kershen, University of Oklahoma* *Michael Gregoire, APHIS-USDA (call in)*
11:45 pm – 12:00 pm	Presentation: Forest Research Advisory Council *Masood Akhtar, Committee Chair*
12:00 pm – 1:00 pm	*Lunch (to be provided for Committee)*
1:00 pm – 1:45 pm	Presentation: GREET Model Development *Michael Wang, Argonne National Laboratory*
1:45 pm – 2:00 pm	Public Comment Period
2:00 pm – 3:30 pm	Breakout: Subcommittees *(Not Open to the Public)*
3:30 pm – 3:45 pm	*Break*
3:45 pm – 5:15 pm	Breakout: Subcommittees *(Not Open to the Public)*

Day 2: Technical Advisory Committee Meeting: August 24, 2011

7:00 am – 7:30 am	*Breakfast (to be provided for Committee)* *Location*
7:30 am – 8:15 am	Presentation: Top 10 Facts about Ethanol Blends *Mark Maher, TAC Member*
8:15 am – 9:45 am	Subcommittee Report Out
9:45 am – 10:00 am	*Break*
10:00 am – 11:30 am	Finalize Recommendations
11:30 am – 12:00 pm	Committee Votes on Recommendations
12:00 pm – 12:15 pm	Discussion: Next Biomass TAC Meeting Agenda Topics
12:15 pm – 12:30 pm	Closing Comments *Co-Chair – Steve Briggs* *Co-Chair – Ronnie Musgrove*
12:30 pm	Adjourn