

**Biomass Research & Development
Technical Advisory Committee**

December 15, 2010

Meeting Summary

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List of Acronyms

Committee - Biomass Research and Development Technical Advisory Committee

Board - Biomass Research and Development Board

DOE - U.S. Department of Energy

USDA - U.S. Department of Agriculture

NAREEE - National Agricultural Research, Extension, Education, and Economics

IBR - Integrated Biorefinery

Biomass Act - Biomass R&D Act of 2000

ARS - Agricultural Research Center

NIFA - National Institute of Food and Agriculture

KDF - Knowledge Discovery Framework

NAABB - National Alliance for Advanced Biofuels and Bioproducts

EERE – Energy Efficiency and Renewable Energy

ORNL - Oak Ridge National Laboratory

GLBRC - Great Lakes Bioenergy Research Center

JBEI - Joint BioEnergy Institute

BCAP - Biomass Crop Assistance Program

AFRI - Agriculture and Food Research Initiative

CAP - Coordinated Agricultural Projects

IABR - Integrated Algal Biorefinery

CFD - Commercial Demonstration Facility

I. Purpose

On December 15, 2010, the Biomass Research and Development Technical Advisory Committee (Committee) held its final quarterly meeting of calendar year 2010. The purpose of the meeting was to receive updates and discuss the recent activities of the U.S. Department of Energy (DOE) and the U.S. Department of Agriculture (USDA). Presentations from DOE included updates on the Biomass Program, Vehicle Technologies, and Office of Science. USDA presentations included Rural Development, Agricultural Research Center (ARS) and National Institute of Food and Agriculture (NIFA). In addition, Oak Ridge National Laboratory (ORNL) gave an overview of the Knowledge Discovery Framework (KDF) tool and Booz Allen Hamilton gave an update on their USDA sustainability study. The afternoon included speakers from the National Alliance for Advanced Biofuels and Bioproducts (NAABB) and an update from the National Agricultural Research, Extension, Education, and Economics (NAREEE) committee.

A list of attendees is provided in Attachment A and the meeting agenda is in Attachment B. 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Background: The Committee was established by the Biomass R&D Act of 2000 (Biomass Act) which was repealed and replaced by Section 9008 of the Food, Conservation, and Energy Act of 2008.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 Secretary of Energy and the Secretary of Agriculture on the direction of biomass research and development.

II. DOE Update

Laura McCann, Biomass Program, DOE

Laura McCann updated the Committee on their 2007, 2008, 2009, and 2010 recommendations and on the 2011 new member nomination process. She announced that Paul Bryan, the new Biomass Program Manager, was unable to attend and meet the Committee, but hoped to do so next meeting.

Future dates for Committee meetings are tentatively scheduled for:

- Week of February 28 – March 4.
- Week of May 16 – May 20.
- Week of August 15 – August 19.
- Week of November 7 – November 10.

The Integrated Process Improvements FOA was announced December 14, 2010. There will be up to \$30 million of funding available for up to 5 projects for the next 3–4 years. They will be seeking small-scale process integration projects that support the development of advanced biofuels that will be able to replace gasoline or diesel without requiring special upgrades or changes to the vehicle or fueling infrastructure. More information is available at:

http://apps1.eere.energy.gov/news/news_detail.cfm/news_id=16568

Neil Rossmeissl, Biomass Program, DOE

Neil Rossmeissl provided an update of the Biomass Program's 27 funded integrated biorefinery (IBR) projects. He mentioned that all projects will have a comprehensive project review performed. The Recovery Act projects are the next group to be reviewed at the comprehensive project review. The next IBR Technology Platform peer review will take place in February and is open to all who wish to attend. The February review also will be conducted as a webinar.

The question was asked if there are key successes listed in the portfolio. Mr. Rossmeissl stated that due to current financial challenges securing debt, equity, or venture capital, most of the DOE projects are seeking loan guarantees. Due to their requirements, each project must submit a loan guarantee application, projects are focused more on results, which will lead to greater successes. Issues that remain are feedstock contracts and the cost of producing clean sugar.

There was a question regarding the Pacific Ethanol project and why it was having success converting C5 sugars, but falling behind with C6 sugars. Mr. Rossmeissl informed the group that Biogasol was licensed by Pacific Ethanol to convert C5 sugars and that C6 sugars were never evaluated. It is expected that the combined JV would eventually be used for C6 conversion.

Todd Werpy asked if, after indentifying key barriers for all cellulosic ethanol projects, enough has been learned to move the needle of success. Mr. Rossmeissl stated that the commercial and demonstration scale projects submitting over 1,000 hours of integrated operation, more knowledge is being learned about the challenges. Such testing has resulted in companies more closely examining their processes and making the appropriate changes like changing the type of conversion processes. Overall, the companies are learning more, resulting in a better overall chance for success.

Kevin Stork, Vehicle Technologies, DOE

Kevin Stork gave an overview of the Vehicle Technologies Program and their work with cars running on biofuels compared to those running on electricity. His presentation considered: (1) greenhouse gas (GHG) emission reduction potential, (2) lifecycle cost, (3) energy density and vehicle range, and (4) cumulative petroleum saving potential. The conclusion was that liquid fuels are likely to be around for a long time and are hard to beat for energy density. Biofuels appear to have more potential for displacing petroleum and reducing GHG emissions in the near-term than using biomass for power generation for electric vehicles.

It was noted that geography affects this type of analysis, as heating and cooling of the car itself in either cold or warm climates can change the results. Mr. Stork acknowledged these issues are valid, but that his analyses did not address them.

Based on the overall conclusions, the question was posed if DOE's Office of Energy Efficiency and Renewable Energy (EERE) and the Vehicle Technologies Program plan on working to make all U.S. vehicles capable of using biofuels in the future. Mr. Stork could not say as they are bound by their budget and the current policies. However, he did note that his analysis could be used to educate policy

makers, and would hopefully result in biomass being used as a renewable fuel in the appropriate sectors. He assured the Committee that the US will continue to look at technology regardless of blend level.

Dr. Catherine Ronning, Office of Science, DOE

Dr. Catherine Ronning provided an update on the Office of Science's Office of Biological and Environmental Research (BER) at DOE. BER's mission is to provide the foundational science to understand complex biological, climatic, and environmental systems across spatial and temporal scales. Dr. Ronning provided funding and progress updates on the Biological Systems Science Division (BSSD) and its Genomic Science Program, which includes the Bioenergy Research Centers, DOE Joint Genome Institute, and USDA-DOE Plant Feedstocks Genomics for Bioenergy. The USDA-DOE Plant Feedstock Genomics for Bioenergy currently has a solicitation open for 2011 with specific interests in the following:

- Phenotyping plant germplasm collections, advanced breeding lines of bioenergy crops (Brachypodium, energy cane, Miscanthus, sorghum, switchgrass)
- Translation of genomics information into cultivar improvement in bioenergy crops (Brachypodium, Miscanthus, Populus, sorghum, switchgrass).

This solicitation schedule is as follows:

- November 1, 2010 Solicitation posted
- December 17, 2010 Pre-applications due
- February 25, 2011 Proposals due

With regard to the Bioenergy Research Centers—such as the Great Lakes Bioenergy Research Center (GLBRC)—being academic-based, Steve Long asked if the Joint BioEnergy Institute (JBEI) also has an academic focus. Dr. Ronning responded that while UC Berkeley does have a presence at JBEI, this center has a focus on eventual commercialization.

Steve Long stated that feedstock research was initially focused on quality, and asked how large a role genomics is currently playing in addressing biomass yields. Dr. Ronning stated that BER is looking at both yield and sustainability factors through the genomic lens.

III. USDA Update

Bill Hagy, Bioenergy Program, Rural Development, USDA

Bill Hagy provided the committee with updates on Title IX Programs, the USDA Biofuels Roadmap, the Biomass Board, and outreach/marketing. Bill suggested that the committee invite the chairs/co-chairs of the Biomass Board Interagency Working Groups to present at the next meeting.

David Bransby asked for an explanation of the two-year limit for the Biomass Crop Assistance Program (BCAP). Mr. Hagy explained that the program was intended to be a seed program for farmers in order to

assist them in getting through the first two years of operations. He added that there will likely be changes in the next Farm Bill to this program.

Jeff Steiner, Agricultural Research Center (ARS), USDA

Jeff Steiner provided an overview of the leadership and research of the USDA Biomass Research Centers & ARS' Contributions. The research centers are networks of existing ARS and Forest Service research locations led by Dr. Steiner and Dr. Marilyn Buford of the U.S. Forest Service Research & Development. The centers leverage current USDA nationwide capacity to lead sustainable biomass production research. The centers coordinate ARS and Forest Service research occurring across different locations into a comprehensive program. NIFA's Agriculture and Food Research Initiative (AFRI) Bioenergy Coordinated Agricultural Projects (CAP) and other extramural funding for regional projects complement these intramural research efforts by ARS and .

Todd Werpy stated that it is necessary to be as efficient as possible along the entire supply chain, and that it needs to be looked at in the global context of food and fiber; he asked if ARS is looking at this. Mr. Steiner replied that one of the objectives of the biomass research centers is to find optimal ways to incorporate biomass production into existing agricultural and forest-based systems to minimize any negative impacts on competing markets and other land uses. From an agricultural lands standpoint, one can review the September USDA report that shows estimates for the extent of biomass and other dedicated feedstock production that is required to meet the 21 billion gallons of advanced biofuel needed under RFS2, beyond the 15 billion gallons of corn starch ethanol. Increasing efficiency means getting more out of the land, so increasing productivity will be necessary to reduce the impacts on existing markets—another objective of the biomass research centers.

Carmela Bailey, NIFA, USDA

Carmela Bailey presented information regarding the NIFA initiatives supporting bioenergy. This presentation included an overview of the NIFA bioenergy portfolio and its new direction, which makes an effort to include sustainability factors. The new directions' focus includes a systems-based approach that values outcomes and impacts rather than just presenting results. The system-based approaches for the AFRI and BRDi grant programs are complementary.

Ed White inquired about funding in 2011 for the Sun Grant Initiative. Ms. Bailey replied that the funding would depend on the continuing resolution. Under the terms of the current continuing resolution, there is \$2 million available for the program.

Todd Werpy asked if the rural-based manufacturing program is designated as such on a function of location or scale. Ms. Bailey stated that USDA is letting the applicant decide if the rural-based designation is determined by location or scale.

IV. Knowledge Discovery Framework (KDF)

Dr. Rahul Ramachandran, ORNL

Dr. Budhendra Bhaduri, ORNL

Dr. Rahul Ramachandran and Dr. Budhendra Bhaduri presented information about—and a demonstration of—the KDF. The KDF site can be accessed at: bioenergykdf.net. The goal of the KDF is to provide data analysis, synthesis, and visualization capabilities that facilitate informed decision making. To accomplish this, a robust geospatial technology and informatics framework has been designed and developed. The KDF connects data, people, and knowledge to build a bioenergy community of practice.

At a minimum, the KDF works as a data repository. A new “associations” feature allows people to associate different datasets. Users can view different models graphically via the map interface. Users can also create a routing database that will be available to the community, which will drive the routing model for the KDF and ensure a consistent baseline is available to be used across companies. The KDF also includes climate modeling. Its release is planned to take place in January.

Todd Werpy brought up two questions regarding corn stover: (1) How much is there total, and (2) how much can be sustainably collected? Laura McCann stated that sustainability considerations were added to the update of the Billion Ton Study. Geographic factors were also considered at the county level. ORNL worked with the Idaho National Laboratory on corn stover updates, and the information will be released once it makes it through DOE concurrence.

Steve Briggs asked what databases are used to keep the KDF current. Dr. Bhaduri informed the group that more than 1,400 datasets are available within the KDF. These databases are not in one location; rather, they are incorporated from remote locations (e.g. weather data from NOAA). Not all data sets are updated in real time. Some are one-off sets that are user updated. It will be key for KDF users to look at the metadata when doing any analysis. Some datasets are privileged information and available for certain users only.

Bill Hagy asked if there is potential for conflicting datasets. Dr. Bhaduri explained that not everyone can upload data to the KDF. There is an expert user community that will determine what datasets can be included to help confirm credibility.

Steve Briggs wanted to know how DOE will draw attention to this new tool. Dr. Bhaduri stated that there is a series of events planned to launch the KDF.

Bill Berg asked what type of audience could use the KDF and what the potential is for misuse. Dr. Bhaduri explained that the KDF was designed to be accessible enough for an 11 year old to produce a report on bioenergy, but powerful enough for a scientist to run meaningful analyses. Dr. Bhaduri feels there is a low chance of misuse based on the carefully selected user community and the importance of model transparency. He also stated that there is a chance of misinterpretation of results, but this is possible with all models.

Stephen Long asked if land cost/use was included in the KDF. Dr. Bhaduri stated that only public data is currently available in the KDF in an effort to use national scale data for consistency.

V. USDA Sustainability Findings

Joel Fetter, Booz Allen Hamilton

Joel Fetter presented preliminary results of the USDA Sustainability Assessment Prototype development activity. The object of this task is to recommend an approach for assessing the sustainability impact of USDA energy RD&D investments. Since September, Booz Allen Hamilton has evaluated hundreds of potential resources and a draft prototype framework has nearly been completed. The prototype is based on a tiered analytical protocol designed to facilitate effective, least-cost sustainability assessments. As a next step, they have begun processing case studies to illuminate how the prototype might work and how it could be used. At present, they are considering the utilization of defined reporting outputs at both the project and Program levels. The next steps will be to finalize the test cases to demonstrate outputs and potential uses, review proposed indicators and analytical methodologies, develop output reports, and convene expert reviews.

Eric Larson asked why he didn't see an explicit reference to GHG emissions on indirect land use change. Mr. Fetter explained that they used the RFS II assessments of GHG emissions for various feedstock and conversion pathways combinations; these assessments are based on lifecycle emissions analyses that include international land use change. This approach was selected to ensure that USDA investment screening activities are consistent with the regulatory frameworks which will govern their ultimate role in the market.

Mark Maher said that he felt the study was mostly organized by qualitative data with some quantitative data. He stated that, if the objective is to evaluate sustainability of projects, the results would be questionable due to the amount of qualitative data. Bill Hagy stated that USDA won't be providing a standard, but would provide the same context for each project. Mr. Fetter explained that not every program uses the same criteria, but there is an ongoing effort to bring commonality to USDA. In addition, he emphasized that many aspects of sustainability, such as the relative weights one places on economics benefits versus environmental integrity, are inherently qualitative.

Craig Kvien questioned whether this process is burdensome and if requiring this information outweighs the benefits of collecting the data. Mr. Fetter explained that the framework is designed to be minimally burdensome on project applicants, and that much of the information requested should be readily procurable by project sponsors. Bill Hagy added that this project is scalable, and USDA is trying to find a happy medium. Mr. Fetter has interviewed all of the agencies to gather feedback.

Steve Long suggested that the farmer level may not be a meaningful level of analysis for commodities like corn, for which decisions relating to ultimate market use (e.g. food, feed, or fiber) is made by grain

elevator operators. Mr. Fetter agreed that it is difficult for a farmer to be ascribed for global changes. Jim Martin added that food safety is keeping prices high enough to ensure a farm safety net. There is enough food to eat, but the issue is price. Supply and demand does not answer all of the questions.

VI. National Alliance for Advanced Biofuels and Bioproducts (NAABB)

Richard Sayre, Donald Danforth Plant Science Center

John Holladay, Pacific Northwest National Laboratory

Drs. Richard Sayre and John Holladay provided an overview of the NAABB and its RD&D program related to algae. They reviewed the technical challenges facing algae-based biofuels and provided updates on current algae research.

Jim Martin noted that the numbers from Sandia National Laboratory are 10 years out of date. He stressed that water is difficult to deal with and expensive to address. Dr. Sayre acknowledged that there are tremendous cost savings to be found in advanced water management including the use of waste water, and that algae-based biofuels are very competitive with terrestrial cropping systems.

Jim Martin asked why it was important to note that the oil mentioned is not food oil. Dr. Sayre responded that he is trying to stem the food vs. fuel vs. fiber issues. The impact of fuel on food prices is small and inconsequential, but fuel production does indirectly compete for resources like land, water, and nutrients.

David Bransby questioned why the Southwest is a big focus area if water is a problem. Dr. Sayre stated that the Southwest is attractive because of the seasonal aspect (i.e. more sunny days), but he acknowledged that water is certainly a constraint. The Southwest is also an attractive area to grow algal biofuels.

Ira Levine asked when the results of the Consortia will become available to the public. Dr. Sayre stated that the IP developed will stay in-house unless it is not picked up in 30 days, in which case it becomes public. Todd Werpy added that there needs to be a way to reward the development of IP; however, there also needs to be more players to make the capital investment necessary to achieve success of the fuel target.

Denise Gitsham, Sapphire Energy

Denise Gitsham gave the committee a presentation on the Integrated Algal Biorefinery (IABR) Commercial Demonstration Facility (CFD). The presentation covered (1) an overview of the location and site, (2) a review of previous work, (3) the basis of the design, (4) a summary of the permitting requirements, and (5) the IABR/CFD Project Execution Plan.

Eric Larson asked where the carbon dioxide (CO₂) is coming from for the process. Ms. Gitsham explained that the focus of the demonstration plant is on fuels distribution and not GHG emissions. She felt it would be hard to imagine a scenario where the economics would work without being co-located with an industrial source of CO₂.

Eric Larson asked about increasing salt concentrations. Ms. Gitsham stated that they use evaporation ponds, but are also looking at developing extremophiles that can stand more salty water. The evaporation loss of water however is very high.

David Bransby stated that normally capital costs are expressed in dollars per gallon annual capacity. The numbers presented show \$90/gallon, and he asked how much they could be lowered. Ms. Gitsham explained that this is a first of a kind facility and believes that they will reduce costs as they build the facilities and learn more throughout the process. Policy issues will also come into play.

VII. National Agricultural Research, Extension, Education and Economics (NAREEE) Update

Carol Keiser-Long, NAREEE Committee Chair

Carol Keiser-Long provided an update to the committee on the NAREEE. She began by introducing the NAREEE Committee members that were in attendance for the TAC meeting. She also informed the committee that corn-based ethanol is a good starting point to get Americans to recognize they can operate vehicles utilizing agriculture technologies. DOE is focused on advanced biofuels to market rather than first generation corn ethanol. The EPA issued the 2011 RFS, which states the need for 21 billion gallons of advanced biofuels. Biofuels will be front and center in the Farm Bill discussion.

She continued with topics that the NAREEE will be considering for its upcoming agenda. These include the following:

- The 2009 report recommended that the committee take a leadership role in examining feedstock sources and sustainability indicators.
- Issues regarding the 2010 report recommending validation of the cellulosic system—regional and at what costs?
- Question: Is sustainability driving cellulosic research or is cellulosic research driving sustainability?
- Where does water fit into renewable energy research?
- Discuss biobased products—heavy supply and heavy demand.
- Accountability of renewable energy project funding.
- Modeling for advanced biofuels relevant to reduction of greenhouse emissions and carbon credits.
- Algal research and what challenges.

- Validation of biomass feedstocks and perhaps segmenting and or integration of product utilization.

VIII. Public Comment

Patrick Serfass, American Biogas Council

Mr. Serfass wanted to introduce himself and inform the Committee that the American Biogas Council was formed in March to assist with anaerobic digesters market opportunities.

Todd Werpy asked about the hurdles of anaerobic digestion commercialization. Since the technology is mature, he asked if challenges were more related to market penetration. Mr. Serfass stated that the United States needs is a better atmosphere for the business. There are a number of incentives in Europe to divert waste from landfills to anaerobic digestion. Many of the small regulations keep digesters from being as cost effective as they could be. He stated that the technology was understood and that they are looking at solid and wet products for use in addition to the biogas benefits and also looking for combined systems where reductions can be made in organic waste.

It was suggested the Mr. Serfass come back and give a formal presentation to the Committee.

Ira Levine updated the Committee that the BCAP program was eliminated or frozen in the Omnibus Appropriations bill December 14, 2010.

IX. Closing Comments

Laura McCann, Biomass Program, DOE

Steve Briggs had to leave the meeting early, so Laura McCann, the designated federal officer, acknowledged those Committee members whose terms are complete and thanked them for their service. Those members are:

- Gil Gutknecht
- Douglas Hawkins
- Bob Dinneen
- Charles Kinoshita
- Ed White
- Eric Larson
- Jay Levenstein
- Jim Martin
- Richard Hamilton.

Attachment A: Committee Member Attendance – December 15, 2010 Meeting

Co- Chairs	Affiliation	Attended?
Gil Gutknecht		NO
Steve Briggs		YES
Members	Affiliation	Attended?
Robert Ames	Tyson Foods	NO
William Berg	Dairyland Power Cooperative	YES
David Bransby	Auburn University	YES
Pamela Reilly Contag	Cygnnet Biofuels	NO
Bruce Dale	Michigan State University	NO
Bob Dinneen	Renewable Fuels Association	NO
Joseph Ecker	Salk Institute for Biological Studies	NO
Richard Hamilton	Ceres Inc.	NO
Douglas Hawkins	Rohm & Haas	NO
Dermot Hayes	Iowa State University	NO
Jennifer Holmgren	LanzaTech	NO
E. Alan Kennett	Gay & Robinson Sugar	NO
Charles Kinoshita	University of Hawaii	YES
Craig Kvien	University of Georgia	YES
Eric Larson	Princeton University	YES
Jay Levenstein	Florida Department of Agriculture and Consumer Services	YES
Stephen Long	University of Illinois	YES
Mark Maher	General Motors	YES
Jim Martin	Omni Tech International	YES
Jim Matheson	Flagship Ventures	NO
Mary McBride	CoBank, ACB	NO
Mitchell Peele	North Carolina Farm Bureau	NO
Michael Powelson	The Nature Conservancy	YES
J. Read Smith	Agricultural Energy Work Group	YES
David Vander Griend	ICM	NO
Todd Werpy	Acher Daniels Midland Company	YES
Edwin White	State University of New York	YES
Rodney Williamson	Iowa Corn Promotion Board	NO

Total – 14 of 30 members attended

Attachment B: Agenda – December 15, 2010 Meeting

Day 1: Technical Advisory Committee Meeting:

December 15, 2010

- | | |
|---------------------|--|
| 7:30 am – 8:00 am | <i>Breakfast (to be provided for Committee)
South Building Cafeteria (private room in the back)</i> |
| 8:00 am – 8:45 am | <i>Welcome and Report Out on Board Meeting
Co-Chair – Steve Briggs</i> |
| 8:45 am – 9:45 am | <i><u>Presentation:</u> DOE Update on Biomass R&D Activities
Laura McCann & Neil Rossmeissl, Biomass Program, U.S. Department of Energy
Kevin Stork, Vehicle Technologies, U.S. Department of Energy
Catherine Ronning, Office of Science, U.S. Department of Energy</i> |
| 9:45 am – 10:00 am | <i>Break
Hallway</i> |
| 10:00 am – 11:00 am | <i><u>Presentation:</u> USDA Update on Biomass R&D Activities
Bill Hagy, Rural Development, U.S. Department of Agriculture
Jeff Steiner, ARS, U.S. Department of Agriculture
Carmela Bailey, NIFA, U.S. Department of Agriculture</i> |
| 11:00 am – 12:00 pm | <i><u>Presentation:</u> Knowledge Discovery Framework
Rahul Ramachandran, Oak Ridge National Lab</i> |
| 12:00 pm – 1:00 pm | <i><u>Presentation:</u> USDA Sustainability Findings
Joel Fetter, Booz Allen</i> |
| 1:00 pm – 2:00 pm | <i>Lunch (to be provided for Committee)
Room 107-A</i> |
| 2:00 pm – 3:30 pm | <i><u>Presentation:</u> The National Alliance for Advanced Biofuels and Bioproducts (NAABB) Algae Consortium
Richard Sayre, Donald Danforth Plant Science Center
John Holladay, Pacific Northwest National Lab
Denise Gitsham, Sapphire Energy</i> |
| 3:30 pm – 3:45 pm | <i><u>Presentation:</u> NAREEE Update
Carol Keiser-Long, NAREEE Committee Chair</i> |
| 3:45 pm – 4:00 pm | <i>Break
Hallway</i> |
| 4:00 pm – 4:15 pm | <i>Public Comment</i> |

4:15 pm – 4:30 pm

Closing Comments
Co-Chair – Steve Briggs

4:30 pm

Adjourn