Meeting Summary:

Biomass Research & Development Technical Advisory Committee

September 9-10, 2008

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I. Purpose

On September 9-10, 2008, the Biomass Research and Development Technical Advisory Committee (Committee) held its third quarterly meeting of calendar year 2008. The purpose of the meeting was to receive updates on recent activities of the Biomass Research and Development Board, the Department of Energy (DOE), and the Department of Agriculture (USDA). The Committee also heard presentations on the renewable identification number system and fuel specifications from the Environmental Protection Agency (EPA), intermediate blends testing program from the Department of Energy (DOE), and the Brazilian pipeline experience from the Department of Transportation (DOT). In addition, the Committee heard a presentation on the Biofuels Metric Study from the National Renewable Energy Laboratory (NREL). There was also a panel discussion regarding Investment in Biorefineries. The Committee members discussed the FY 2008 Recommendations to the Secretaries and FY 2009 Committee Work Plan. The one and a half-day meeting was held at the American Petroleum Institute in Washington, D.C.

Background: The Committee was established by the Biomass R&D Act of 2000 (Biomass Act) which was revised by the Food, Conservation, and Energy Act of 2008. The Biomass R&D Board was established under the same act to conduct Federal strategic planning and 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 evaluating and engaging in strategic planning.

A list of attendees is provided in Attachment A. The agenda is provided in Attachment B. Meeting presentations are provided in Attachment C.

II. Update on Biomass R&D Board Activities

Thomas Dorr, Under Secretary for Rural Development at the U.S. Department of Agriculture, gave an update on recent Biomass R&D Board activities. Mr. Dorr explained that the National Biomass Action Plan had been reviewed and approved by both the Department of Energy (DOE) and the Department of Agriculture (USDA). Mr. Dorr extended an invitation to the Committee to attend the National Biofuels Action Plan release event.

Some of the challenges Mr. Dorr stated need to be addressed included: sustainability and green house gas emissions. Additional challenges included blenders credit issues, import tariffs and the further technical and commercial development of cellulosic ethanol.

Mr. Dorr indicated to the Committee that the Farm Bill was passed into law and was effective June 18, 2008. Secretary of Agriculture Edward Schafer established a team to

implement the Farm Bill, specifically, a broad perspective of issues and opportunities for the biomass industry are discussed within section 9008

Mr. Dorr reinforced the idea that embracing science, technology and change, all within the free market system will be a key to fulfilling the nation's future energy needs.

III. U.S. Department of Agriculture Overview

Bill Hagy, Deputy Administrator of Business Programs in Rural Development at the Department of Agriculture, announced the re-engagement of Booz Allen Hamilton to and continue to assist with the initiative's executive focus. A brief summary of Booz Allen Hamilton's task was presented to the Committee and is described below.

USDA/DOE Section 9008 Program: Reporting on Past Awards

Mike Miller of Booz Allen Hamilton gave a brief presentation on the USDA/DOE Section 9008 Program. They will work with both DOE and USDA to evaluate the awards, current status, and results and benefits that have been realized. Mr. Miller emphasized the recommendation from the metrics study of the need to be able to track the project outcomes over time and have a better framework for collecting data. He also indicated the need to identify data gaps and recommended process improvement. The goal of this project is to eventually have a real time database of the projects awarded under Section 9008 and analysis of results and benefits.

Overview of U.S. Department of Agriculture Activities

Mr. Hagy informed the Committee that a team had been formed that will assist in the implementation of the Farm Bill. Related to Title IX, among other areas, the implementation team will support repowering assistance.

A Bioenergy Program for Advanced Biofuels was also part of the implementation plan. Because of the interest in additional advanced biofuels, there has been a Notice of Funding Availability drafted.

Section 9008, the DOE-USDA Joint Solicitation, now gives latitude to decide how much funding to allocate to the three topic areas (15% minimum per area is required). A Subcommittee was established to provide feedback on both the allocation of funds across topic areas and the evaluation criteria. Only members whose affiliations would not submit proposals to the 9008 solicitation were able to participate.

IV. U.S. Department of Energy Overview

The U.S. Department of Energy (DOE)'s Designated Federal Officer for the Biomass R&D Technical Advisory Committee, Valri Lightner, gave an update on the Biomass Program's activities since the May meeting. Ms. Lightner explained that the DOE is continuing its focus on cellulosic ethanol and advanced cellulosic biofuels. The DOE Office of the Biomass Program (OBP) short term goal is to foster breakthrough technologies needed to make cellulosic ethanol cost-competitive by 2012. In the mid-term, OBP will help to create an environment conducive to maximizing the sustainable production of biofuels by 2017, including cost-effective technology, sufficient infrastructure, appropriate policies, and educated consumers. In the long term, OBP is working to increase the supply of renewable fuels to 36 billion gallons by 2022, specifically focusing on the 21 billion gallons of advanced biofuels (per the Renewable Fuel Standard as outlined in the Energy Independence and Security Act of 2007).

Several solicitations have been awarded that will increase research and development in OBP priority areas. These areas include ethanologen, enzyme, gasification, and the 2007 joint DOE-USDA solicitation. In all cases funding has increased from prior years. In addition, the DOE has invested significantly in four commercial- scale integrated biorefinery plants, and nine 10 percent of commercial scale demonstration level integrated biorefineries. Ms. Lightner also spoke on intermediate blends testing, an alternate approach to get market penetration of alternative fuels. Report One with initial results from the Department of Energy's intermediate ethanol blends test program is due out shortly.

V. Biofuels Beyond Ethanol Scoping Study

David Hsu of the National Renewable Energy Laboratory began his presentation by explaining the advantages and limitations of ethanol. Some of the advantages are that corn and sugar ethanol are already commercial and being used as oxygenate blends with gasoline at concentrations up to ten percent. Ethanol helps lower greenhouse gase emissions and improves energy security. Some limitations of ethanol are that it has a low energy density, it is corrosive, mixes with water, and is only partially compatible with existing infrastructure.

Hsu then went on to explain the current transportation options for biofuels; specifically, biomass feedstocks and their intermediates that are used to create the different biofuel transportation fuels.

Hsu explained the rationale behind the methodology, which begins with a down-select matrix for biofuel technology development. This matrix uses four factors; economic (costs, risks, returns), technology (yield, maturity, complexity), sustainability (GHG, water, toxicity), fuel quality (compatibility, emissions). The second step of the methodology is modeling, or developing mass/energy balance models and financial models based on common assumptions. The third step of the methodology is evaluation, using the models to evaluate down-selected technologies based on economic, sustainability, and other metrics. This methodology was used by NREL when evaluating

several biofuels; Fischer Tropsch diesel, methanol-to-gasoline, pyrolysis, butanol, mixed alcohols, renewable alkanes, hydrogenation-derived renewable diesel, and algal biomass.

Following his presentation, Hsu explained that algae has a lower footprint than other types of biomass feedstocks. Algal biofuel has the possibility of being used for jet fuel.

Discussion Following Presentation:
Hsu reinforced that the motivation behind this study was to further the awareness of the types of advanced biofuels that are in development and barriers facing their commercialization. In addition, it was obvious to Hsu and the committee that each type of technology described had weak aspects associated with them, but could possibly be improved with future technology advancements.

VI. RIN System and Fuel Specifications

John Weihrauch of the Environmental Protection Agency began his presentation by explaining that the Renewable Fuel Standard (RFS) does not track renewable volume distribution. The RFS program does not issue tax credits; rather the IRS administers the blended fuel credits.

Weihrauch then gave the Committee an update on the Texas Waiver Request, which was denied by the EPA on August 7, 2008 based on evidence that the implementation of the RFS would have no significant impact in the relevant time frame, and even if the RFS mandate were to have an impact on the economy in 2008/9 it would not be of a nature or magnitude that could be characterized as severe.

Weihrauch explained the many issues that have come about with implementing the new RFS, largely due to the difficulty understanding the EPA's reporting system. In an attempt to rectify these issues, the EPA is administering a new concept for an EPA-moderated renewable identification number (RIN) trading system that would have a single introduction point, thus reducing potential errors and simplify processing corrections. This system reduces the areas that an error can be introduced.

Discussion Following Presentation:
Weihrauch began the discussion answering a question about who is allowed to purchase RINs, claiming that when a RIN is separated from volume anyone can become an investor. With the existing program, there is presumptive liability for producers, meaning that if the RIN has errors there is the possibility of significant fines.

Regarding an exported fuel, the obligated party needs to meet a standard based on their export amount (must provide RIN).

Regarding the Texas waiver request, the EPA developed guidelines for future waiver applications which will require analytical modeling or other type of validation of the potential impact for an application to be considered.

Some clarification on terminology was asked for by committee members: A RIN Generator is the renewable producer or importer (anyone who introduced a renewable fuel). An obligated party is the importer or producer as well.

VII. U.S. Department of Energy Intermediate Ethanol Blends Test Plan

Kevin Stork of the U.S. Department of Energy's Vehicle Technologies Program described for the Committee the Department's intermediate ethanol blends test program. His presentation outlined the program and the current status of its research projects. Mr. Stork also presented the issues faced in trying to meet the RFS outlined in the Energy Independence and Security Act (EISA) of 2007 with ethanol, and utilizing E85 and flex-fuel vehicles.

The renewable fuel standard was expanded by EISA to 36 billion gallons of renewable fuel per year by 2022. Current ethanol markets are not able to absorb volumes specified by EISA, therefore, DOE is working to ensure that all states blend to E10 and significantly expand E85 markets. Another strategy is the use of "intermediate blends" of ethanol mixed with gasoline (15%-20% ethanol) and let market forces drive ethanol supply distribution.

The DOE intermediate blends test program was initiated in August 2007 with organizational meetings between various federal agencies and national laboratories (DOE, EPA, State of Minnesota, the National Renewable Energy Laboratory and Oak Ridge National Laboratory). That summer, the project gave small, non-road engines (SNRE) priority at EPA request. In addition, some of the tests leveraged other engine tests with the Coordinating Research Council (CRC) and EPA. Vehicle evaluations began in late 2007. A specialty engine test plan is currently under development and includes marine, motorcycles, and snowmobiles.

The first report with initial results from the test program will be released to the public in the near future.

VIII. Brazilian Pipeline Experience

Robert Smith of the U.S. Department of Transportation gave a presentation on Brazil's experience with ethanol and its transport of the fuel. Brazil is significantly more advanced than the U.S. in regards to production, transportation, distribution, and social education of biofuels. Smith then discussed the history of the Brazilian ethanol industry,

beginning in the 1970's. Today, cars and light trucks in Brazil use flex fuel technology and can run on 100 percent alcohol fuel. Brazil exports only limited amounts of ethanol. Petrobras, Brazil's state owned ethanol company, claims that there is no stress corrosion or cracking problem in any batched or dedicated hydrous alcohol/ ethanol pipelines. Due temperatures below freezing in the US, anhydrous ethanol must be used, for which there has been documented stress corrosion cracking in pipelines. Only a small portion of the agricultural lands used to grow sugarcane are utilized, thus there is vast room for expansion of Brazil's ethanol industry.

Discussion Following Presentation:
Following Smith's presentation, he explained that Brazil's 500-700 miles of ethanol pipelines will transport over 133 million barrels in 2008 and will likely continue to expand significantly. Petrobras has opposed releasing information on product quality/ integrity for pipeline systems, which makes it difficult to replicate their pipeline systems. In the U.S., many products are transported through pipelines and our infrastructure is much older. Meanwhile, there has been a lot of pipeline work in the U.S. on transporting corn ethanol.

Smith indicated that studying Brazil's pipeline system has allowed for better roadmapping of how an ethanol pipeline system could be implemented in the U.S.

IX. Metric Study

Dr. Helena Chum of the National Renewable Energy Laboratory presented the metrics study, which evaluates USDA section 9008 awards from the fiscal years 2002 to 2005. This study also attempts to provide general assessments of performance measures that could lend themselves to tracking of current and future benefits of the program. There were 20 projects within this study that were analyzed for outcomes, while 41 projects were analyzed for overall processes.

In regards to qualitative and quantitative metrics, Dr. Chum explained that discovery and innovation are difficult to measure with quantitative metrics, and the most efficient approach is to use process and input metrics that ensure the promotion of discovery and innovation. As the science of this subject matures, more appropriate output metrics and outcomes will emerge from these activities. Hybrid qualitative and quantitative measures offer the best strategic guidance.

Dr. Chum summarized the 20 USDA section 9008 projects as of May 2007. Of the projects, 6 projects dealt with R&D, 5 were demonstration and feasibility studies, 2 were first commercial projects, 1 dealt with analysis, 4 with RD&D and refined prototypes, and 2 dealt with outreach and training. The total investment for these projects in FY2003-FY2005 was $44 million, 5.4 percent of all USDA and 4 percent of all USDA/DOE investments in the period.

Dr. Chum summarized the final outcomes of the study by identifying several important metrics: number and amount of biobased products directly incorporated into

manufactured products, number of companies and amount of biofuels and bioelectricity produced, existing biorefineries commercializing process improvements and products from RD&D and new commercial biorefineries. Dr. Chum identified indices for economic/financial outputs per dollar of program investment (total or by technical area that generated the impacts), and several environmental quality and sustainability indices. The goal of the study is to be able to track the long-term societal, economic, and environmental benefits of the outcomes of the program.

X. Panel Discussion: Financial Community on Investment in Biorefineries

Representatives from cellulosic ethanol producers, venture capital and project finance firms participated in a panel discussion to provide perspectives on investment in biorefineries. Participants in the panel were as follows:

Cellulosic Ethanol Perspective:
-Bruce Jamerson, CEO, Mascoma Corporation
-Mitch Mandich, CEO, Range Range Fuels
-Gary Luce, CEO, Terrabon LLC
Venture Capital Investor Perspective:
-Marianne Wu, Partner, Mohr Davidow Ventures
Project Finance Perspective:
-Todd Alexander, Partner, Chadbourne & Parke, LLP

Panel participants provided an overview of their firms and went on to answer questions provided to them ahead of time by Committee members. The Committee was then free to ask panelists individual questions.

A summary of the dialogue follows:

Q: As the biofuels industry transitions from a research stage to further developmental stages, what should the government role become?

Bruce Jamerson:
In order for a biorefinery to achieve commercial scale, a loan guarantee is crucial. After first plants are constructed more lenders and investors are going to become invested in the technology. There is also a need to encourage long term planning and technology development of feedstocks.

Mitch Mandich:
Government support in the form of mandates and incentives help spur private investment. Mandich also emphasized that there must be a combination of financing vehicles in order for things to be successful. He then posed the question of how much risk is the federal government willing to take for the construction of these plants to start producing?

Gary Luce:
Loan guarantees are critical and should be focused on local municipalities.

Marianne Wu:
The primary issue for successful biorefineries is the access to capital. She described the need to clear the financing gap between the lab and the plant.

Q: How much will it cost (meaning how much in capital costs; total capital, and capital cost) per gallon per technology?

Bruce Jamerson:
A 40 million gallon facility would be approximately $5-6 per gallon for capital cost and $1.50 per gallon for operation cost. This is a conservative estimation.

Mitch Manderson:
A 100 million gallon facility may cost $225 million. The feedstock and marginal costs are competitive, but the capital cost is a problem.

Gary Luce:
Estimated initial deployment is 200-300 tons per day, but is subject to change with different feedstocks. Feedstock costs range from $1.20-$1.35. In addition, the development of partners greatly helps achieve commercialization.

Q: What criteria are important to make the biorefinery loan guarantee program most successful?

Marianne Wu:
There is a lot less investor risk when federal money is invested in a demonstration plant. There should be transparency in criteria and processes and increased focus on productivity yield on farm and factory. In addition, there should be a balance in technology focus and stability on the focus of government loans and technology area of these loans. An issue affecting the amount of private investment in these facilities is the lack of a success story in the industry.

Todd Alexander:
The loan program is to foster new technologies which will reduce greenhouse gases. No one has received a loan guarantee yet and lots of things have to occur for this program to actually work. Congress did not appropriate the money for the program, therefore there is a subsidy charge for each company who gets funds and the amount is not clear.

Bruce Jamerson:
Bruce expressed that 100% of the funding should be guaranteed for demonstration scale plants, rather than 80%. With that, only the best companies with proven technology should be funded in order ensure the success of these projects. It was pointed out that other countries have expressed interest in these plants and were willing invest in 100% of

the plants cost. There is also a need for partners that can keep up with the technology advances within the industry and the market changes.

Q: Are there sustainability issues associated with the development of these integrated biorefineries?

Mitch Mandich:
There probably will be. Working with environmental groups is needed to be able to continue to have abundant feedstock supply and continued positive life cycles.

Q: When having a feedstock that isn't food, like wood for example, can you lock in long term price?

Mitch Mandich:
This is possible, but would have a huge premium associated with it.

Q: Why not go to another country?

Bruce Jamerson:
It is hard to manage offshore, especially with a complex technology such as this. There is a need for more education in the United States as well.

Marianne Wu:
The scenario is similar in other industries. Technology grows in the U.S. then commercialization goes overseas because of quicker scale up.

Q: Regarding intermediate blends, are investors worried about blend wall?

Marianne Wu:
Investors see the mandates as favorable for biofuels. Blenders must do something with the cellulosic ethanol, which means higher blends and more education programs for E85 stations are needed. There's a strong belief that the Farm Bill will provide a market for plants to scale up slowly. World competition is a good market indicator. Intermediate blends will eventually exhaust themselves when cellulosic ethanol becomes commercial.

XI. FY 2008 Recommendations to the Secretary

The Committee used the recommendations drafted by the four subcommittees (Feedstocks Production and Logistics, Conversion, Infrastructure and End Use and Environment, Health and Safety) as a starting point to discuss the final recommendations. Members voted on which recommendations and concepts should be incorporated into the final document. The Committee agreed to have federal agency support staff work on final edits to the document for distribution to and approval by the Committee.

XII. 2008/2009 Committee Work Plan

Several issues were discussed in regards to the Committees FY 2009 work plan. The Committee discussed possible locations for their second meeting of FY 2009. This meeting will either be held in conjunction with the RFA National Ethanol Conference – (February 23-25, in San Antonio, TX), or with the U.S. Department of Energy's Biomass 2009: Fueling our Future Conference (March 17-18, in Washington D.C.).

The agenda for the next meeting (December 2-3, 2008 in Washington, D.C.) was also discussed. In an attempt to speed up the process of getting Committee recommendations to the Board members, the Committee recommendations need to be finalized as soon as possible. The Committee also discussed the need for a better definition of the subcommittee missions. Once the action plan is publicly released there will be a better definition of duties for committee members.

XII. Public Comment

There was no public comment made at the September 2008 meeting of the Technical Advisory Committee.

Attachment A: Attendees

Committee Members Present (21)

W. Henson Moore (co-chair)
Gil Gutknecht (co-chair)
Robert Ames
David Anton
Bill Berg
Thomas Binder
Ralph Cavalieri
Scott Faber
Doug Hawkins
Charles Kinoshita
Eric Larson
Jay Levenstein
Mark Maher
Jim Martin
Scott Mason
Mary McBride
Shirley Neff
Mitch Peele
Jeffrey Serfass
Robert Sharp
Rodney Williamson

Committee Members Not Present (10)

Bob Dinneen
Richard Hamilton
Lou Honary
E. Alan Kennett
Tim Maker
John McKenna
Tom Simpson
J. Read Smith
Richard Timmons
Ed White

Biomass R&D Board Members Present (1)

Tom Dorr (co-chair), USDA

Federal Employees Present (13)

Doug Faulkner, USDA
William Hagy III, USDA
Jacques Beaudry-Losique, DOE
Alicia Lindauer-Thompson, DOE
Neil Hoffman, USDA
Robert Smith, DOT/PHMSA
David Hsu, NREL
Barbara Twigg, DOE
Zia Haq, DOE
Steve Przesmitzki, NREL
Helena Chum, NREL
Kevin Stork, DOE
Adam Giuzzo, USDA, FSA

Other Attendees (17)

Michelle Avillanoza, New West Technologies
Jess Capito, EESI
Emily Marthales, Midwest Governors Association
John Kneiss, Hart Energy Consulting
Al Mannato, API
Carol Keiser, NAREE
Martin Massengale, Chair, NAREE Advisory Board
Karen Hunter, NAREE Executive Director
Mike Miller, Booz Allen Hamilton
Ken Saenz, Booz Allen Hamilton
Bruce Bauman, API
Steven Davey, Zymetis, Inc
Marianne Wu, MDV
Jonathon Lehman, American Capital Group
Joey Blanchard, Chevron
Carolyn Clark, BCS
Carl Wolf, BCS

Designated Federal Officer – Valri Lightner, DOE

Total Public Attendees - 12
Total Attendees- 63

Attachment B: Agenda

Day 1: September 9, 2008

Tour: Kinder Morgan Terminal

8:00 a.m.	Shuttle bus leaves for Kinder Morgan terminal
9:00 a.m. – 11:00 a.m.	Tour of Kinder Morgan terminal facilities
12:00 p.m.	Arrive at API in Washington, D.C.
12:15 p.m.	*Lunch*

Meeting: API, Washington D.C.

12:30 p.m. – 12:45 p.m.	Welcome *Co-Chairs: Henson Moore and Gil Gutknecht*
12:45 p.m. – 1:15 p.m.	Opening Comments and Update on Biomass R&D Board Activities *Thomas Dorr, Under Secretary for Rural Development, U.S. Department of Agriculture*
1:15 p.m. – 2:00 p.m.	Presentation: USDA Update *Bill Hagy, Rural Development, U.S. Department of Agriculture*
2:00 p.m. – 2:45 p.m.	Presentation: DOE Update *Valri Lightner, Biomass Program, U.S. Department of Energy* • DOE Biomass Program Updates • FY 2008 Joint Solicitation • Discussion of Joint Solicitation Topic Areas and Criterion
2:45 p.m. – 3:15 p.m.	Presentation: Biofuels Beyond Ethanol Scoping Study *David Hsu, National Renewable Energy Laboratory*
3:15 p.m. – 3:30 p.m.	*Break*
3:30 p.m. – 4:00 p.m.	Presentation: RIN System and Fuel Specifications *John Weihrauch, EPA*

Day 1: (continued) **September 9, 2008**

4:00 p.m. – 4:30 p.m.	Presentation: Department of Energy Intermediate Blends Test Plan *Kevin Stork, Vehicle Technologies Program, U.S. Department of Energy*
4:30 p.m. – 5:00 p.m.	Presentation: Brazilian Pipeline Experience *Robert Smith, PHMSA, U.S. Department of Transportation*
5:00 p.m. – 5:15 p.m.	FY 2008 Recommendations Walk-Through *Co-Chairs: Henson Moore and Gil Gutknecht*
5:15 p.m. – 5:30 p.m.	Public Comment/Adjourn

Day 2 **September 10, 2008**

Meeting: API, Washington, D.C.

7:30 a.m. – 8:00 a.m.	*Breakfast*
8:00 a.m. – 9:00 a.m.	Discussion: Approve FY 2008 Recommendations to the Secretaries
9:00 a.m. – 9:45 a.m.	Presentation: Metric Study *Helena Chum, National Renewable Energy Laboratory*
9:45 a.m. – 10:00 a.m.	*Break*
10:00 a.m. – 11:30 a.m.	Panel Discussion: Financial Community on Investment in Biorefineries *Cellulosic Ethanol Representative Perspective* *- Bruce Jamerson, CEO, Mascoma -- Enzymatic* *- Mitch Mandich, CEO, Range Fuels -- Thermochemical* *- Gary Luce, CEO, Terrabon L.L.C. -- Acid Fermentation* *Venture Capital Investor Perspective* *- Marianne Wu, Partner, Mohr Davidow Ventures* *Project Finance Perspective* *- Todd Alexander, Partner, Chadbourne & Parke, LLP*
11:30 a.m. – 12:30 p.m.	*Lunch*
12:30 p.m. – 2:15 p.m.	Discussion: Approve FY 2008 Recommendations to the Secretaries
2:15 p.m. – 2:30 p.m.	*Break*
2:30 p.m. – 3:15 p.m.	Discussion: Approve FY 2008 Recommendations to the Secretaries
3:15 p.m. – 3:30 p.m.	Discussion: 2008/2009 Committee Work Plan
3:30 p.m. – 3:45 p.m.	Public Comment
3:45 p.m.	*Closing Remarks/Adjourn*