

**Biomass Research and Development
Technical Advisory Committee**

August 19–20, 2014

Meeting Summary

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List of Acronyms

AFRI – Agriculture and Food Research Initiative
ARS – Agricultural Research Service
BCAP – Biomass Crop Assistance Program
BETO – Bioenergy Technologies Office
Biomass Act – Biomass Research and Development Act of 2000
BRDI – Biomass Research and Development Initiative
CBiRC – Center for Biorenewable Chemicals
Committee – Biomass R&D Technical Advisory Committee
DOE – Department of Energy
EERE – Energy Efficiency and Renewable Energy
EPA – Environmental Protection Agency
FOA – Funding Opportunity Announcement
GHG – Greenhouse gas
ICC – International Code Council
MYPP – Multi-Year Program Plan
NFPA – National Fire Protection Association
NIFA – National Institute of Food and Agriculture
NSF – National Science Foundation
R&D – Research and development
RFS – Renewable Fuel Standard
USDA – U.S. Department of Agriculture

I. Purpose

On August 19–20, 2014, the Biomass Research and Development Technical Advisory Committee (“the Committee”) held its third quarterly meeting of 2014. The Committee received updates about the U.S. Department of Energy’s (DOE’s) Bioenergy Technologies Office (BETO), and U.S. Department of Agriculture (USDA) representatives delivered presentations about current USDA activities. The Committee was also given an overview of the BETO Multi-Year Program Plan (MYPP). In addition, a panel session was held to discuss biomass products.

See Attachment A for a list of meeting attendees. See Attachment B to review the meeting agenda.

Meeting presentations can be viewed on the BRDI website at the following link:

<http://biomassboard.gov/committee/meetings.html>.

Background: The Committee was established by the Biomass Research and Development Act of 2000 (“Biomass Act”), which was later repealed and replaced by Section 9008 of the Food, Conservation, and Energy Act of 2008. The Biomass Research and Development Board (“the Board”) was established under the same legislation to coordinate activities across federal agencies. This has recently been reauthorized in the Agricultural Act of 2014. The Committee is tasked with advising the Secretary of Energy and the Secretary of Agriculture on the direction of biomass research and development (R&D).

II. Welcome

Kevin Kephart, Committee Co-Chair

Pamela Contag, Committee Co-Chair

Dr. Kephart and Dr. Contag welcomed the Committee to the third meeting of the year and called the meeting to order.

III. Committee Business for 2014 and U.S. Department of Energy Updates

Elliott Levine, U.S. Department of Energy, Designated Federal Official

Mr. Levine began by providing an overview of the Committee’s work plan and process for the rest of the year to complete the development of the annual recommendations. He provided a summary of the Bioeconomy workshop that was held July 31, 2014. This workshop, planned by the Biomass R&D Board, focused on two main components: (1) two question and answer periods were conducted to inform the public on the Biomass R&D Board and the potential for an expanding bioeconomy, and (2) three public comment sessions were held on Feedstocks and Logistics, Conversion Technologies, and Distribution and End Use to discuss the opportunities and challenges facing the bioenergy sector today. Input from the workshop is being consolidated and reviewed and will be presented at the September Board meeting.

Mr. Levine also provided updates on the following recent BETO award announcements:

- DOE announced \$3.5 million in additional funding to support its goal of producing 2,500 gallons of algal biofuel feedstock per acre per year by 2018—an important milestone

toward reducing the cost of algal biofuels to cost-competitive levels of 5,000 gallons per acre per year by 2022.

- DOE announced \$6.3 million in additional funding to support lowering production costs by maximizing the renewable carbon and hydrogen from biomass that can be converted to fuels and improving the separation processes in bio-oil production to remove non-fuel components.
- DOE announced \$11.3 million to develop a cost-competitive pathway to produce high-performance carbon fiber for vehicle lightweighting from renewable non-food biomass.

Future Award Announcements:

- BETO Incubator (DE-FOA-0000974)
 - Submission deadline was May 23, 2014. DOE expects five awards to be issued.
- Biological and Chemical Upgrading for Advanced Biofuels and Products (DE-FOA-0001085)
 - Concept paper submission closed May 1, 2014. Full applications were due June 13, 2014. Up to \$10 million total funding is available with expected award size between \$1.0 million–3.5 million for up to 36 months.

Mr. Levine highlighted that DOE has joined Farm-to-Fly 2.0 Initiative. In July 2014, the Secretary of Energy signed an amendment officially making DOE the newest partner agency in this significant initiative. This effort seeks to increase the nation's supply of renewable jet fuel with the end goal of producing about 1 billion gallons of drop-in aviation biofuels per year by 2018. DOE is actively committed to accelerating the adoption of sustainable aviation biofuels that require no jet engine modifications. Mr. Levine also highlighted future BETO priorities in production and logistics, algae, conversion technologies, and analysis and sustainability.

Mr. Levine provided a summary of recent and upcoming events:

- The Biomass 2014 annual conference was held July 29–30, 2014 in Washington D.C. *Biomass 2014* recorded a two-day attendance of 580 individual attendees.
- The Bioenergy Industry Codes and Standards Workshop was held July 31, 2014 in Washington, D.C. The workshop focused on recent changes being made to the 2015 editions of the both the International Code Council (ICC) and the National Fire Protection Association (NFPA) international fire and building codes.
- The Waste-to-Energy Workshop will be held in fall 2014 in Arlington, Virginia. The workshop will gather waste-to-energy experts to identify key technical barriers to the commercial deployment of liquid transportation fuels from waste feedstocks and to ultimately develop a roadmap that highlights the key pathways and metrics to meeting this goal.

Mr. Levine provided an update on other DOE offices, including the Vehicle Technologies Office and the Office of Science:

- Vehicle Technologies Office:
 - I-75 Clean Fuels Corridor Continues Success: Supported by a 2009 award from the Energy Department’s Clean Cities program, the 1,786-mile route now includes 26 retail stations selling E85 and 9 stations selling B20.
- Office of Science:
 - Plant Feedstocks Genomics for Bioenergy (DE-FOA-0001034)
 - Ten awards totaling \$12.6 million in total funds (FY 2014–FY 2016), including two funded by USDA’s National Institute of Food and Agriculture (NIFA).
 - Systems Biology of Bioenergy-Relevant Microbes to Enable Production of Next-Generation Biofuels (DE-FOA-0001060)
 - Fourteen awards totaling \$19.6 million in total funds (FY 2014–FY 2016).

IV. U.S. Department of Agriculture Updates

Todd Campbell, Energy Policy Advisor, U.S. Department of Agriculture

Harry Schomberg, Senior Advisory Bioenergy and Natural Resources, U.S. Department of Agriculture

Mr. Campbell provided updates on the following activities at USDA:

- Biomass Crop Assistance Program (BCAP)
 - USDA selected 36 energy facilities in 14 states to accept biomass deliveries supported by BCAP. Of the total \$25 million per year authorized for BCAP, up to 50% (\$12.5 million) is available each year to assist biomass owners with the cost of delivery of agricultural or forest residues for energy generation.
- Repowering Assistance Program
 - The repowering assistance program is for eligible biorefineries to replace fossil fuels to produce heat or power with renewable biomass. Up to \$12 million in payments are available. Application deadline is September 15, 2014.
- BioPreferred
 - The final rule issued by the 2014 Farm Bill eliminates the restrictions on including mature market wood products and other materials in the BioPreferred Program. It also establishes a procedure to designate “intermediate ingredients” so products made from them can be included in the “preferred” federal procurement process. It also establishes procedures for designating “complex assemblies” that contain one or more components made from biobased ingredients.
- Sun Grant
 - USDA solicited applications for \$2.5 million in funding from the National Institute of Food and Agriculture’s (NIFA’s) Sun Grants program for bioenergy and biomass research

collaboration between government agencies, land-grant institutions, and the private sector. Application period closes July 9.

- Farm to Fleet
 - Inland/East/Gulf Coast bulk fuels solicitation was released by the Defense Logistics Agency-Energy for F-76 & JP-5 and closed July 17.
- Biogas Opportunities Roadmap
 - To accelerate the use of cost-effective methane energy technology, the Opportunities Roadmap details a number of steps to help improve return on investment and expand America's biogas industry, including the following:
 - Promoting biogas utilization through existing agency programs
 - Fostering investment in biogas systems
 - Strengthening markets for biogas systems and system products
 - Improving communication and coordination.

Mr. Campbell also provided an update on the USDA Energy Web Portal, which enables users to access a complement of web-based products and information, statistical data, and other resources regarding the bioeconomy.

V. Overview of DOE Bioenergy Technologies Office Multi-Year Program Plan

Amy Schwab, National Renewable Energy Laboratory—Systems Integration

Amy Schwab from the National Renewable Energy Laboratory provided an overview of the most recent BETO Multi-Year Program Plan (MYPP). The purpose of the MYPP is to articulate BETO's mission and goals to internal and external stakeholders over a 5–10 year planning horizon. The plan is updated annually to reflect and align with current strategic priorities. The focus of the 2014 MYPP goes beyond biomass to bioenergy.

Ms. Schwab then provided highlights of the following sections of the MYPP:

- Feedstocks Supply & Logistics R&D
- Conversion R&D
- Demonstration and Deployment
- Crosscutting

She also highlighted a few areas where changes can occur in future updates:

- New technology pathway design cases/goals and targets
- Expanded role of products as enablers to biofuels
- Expanded focus on markets beyond light-duty vehicles.

The latest version of the MYPP can be found at the following location:

energy.gov/sites/prod/files/2014/07/f17/mypp_july_2014.pdf

VI. U.S. Biomass Products Panel

Dr. Brent H. Shanks, Director, National Science Foundation (NSF) Engineering Research Center for Biorenewable Chemicals (CBiRC), Iowa State University

Bill Tittle, Nexant, Renewable Chemicals & Materials

Dr. Brent Shanks from the NSF Engineering Research Center for Biorenewable Chemicals (CBiRC) gave an overview of the future direction of bioproducts. He started by giving a breakdown of products from a barrel of oil and showing the amount of chemicals that can be produced commercially from bio-based products. The CBiRC approach focuses on the sugars, fermentation, and intermediates stages in the processing chain. He then explained the difference of developing products from the petrochemical industry vs. the biobased chemicals. Biobased chemicals focused more on platforms that can produce multiple chemical products. He then provided examples with various platforms such as fatty acid biosynthesis, microbial engineering, catalysis, and the triacetic acid lactone platform.

Mr. Bill Tittle from Nexant then provided a summary of the Renewable White Paper Seminar. The primary objectives of this white paper were to do the following:

- Estimate the potential for U.S. bio-based chemicals and materials
- Assess the competitiveness of bio-based chemicals and materials versus traditional petrochemicals and the competitiveness of the United States compared to other countries
- Investigate whether industry development is being constrained by the reluctance to finance first-of-a-kind commercial operations, suggesting a need for a public/private effort to de-risk these investments.

He then went through the renewable chemicals value chain and cost competitiveness for feedstocks, conversion technologies, chemicals/plastics, fabrication technologies, and end products. He provided further details on C2, C3, C4, and aromatics. Other topics discussed were the impact of shale gas and shale oil, renewable chemicals U.S. market potential, environmental benefits, and obstacles to development and de-risking strategies. The conclusions of the white paper were the following:

- Technology advances in the sector have been dramatic, and an upside potential model has been developed using historical technology advances in agricultural biotechnology with similar technology enablers. The model results suggest the potential could be six times the levels in the report, including the following characteristics:
 - Market size almost 20 million metric tons per year in 10–15 years
 - More than 100,000 jobs created
 - \$18 billion in annual value-added created.

VII. Subcommittee Breakout Summaries

The subcommittees discussed and reported back on discussion related to the following topics:

Conversion

Challenges/Problem Statement:

Problem Statement: Biomass conversion plants require substantially higher capital expenditure per gallon capacity than starch/sugar ethanol plants or biodiesel plants because biomass processing is more complex and entails a greater number of unit operations than conventional biofuel facilities. The typical solution to high capital cost is to increase scale by building larger facilities. In the case of biomass processing plants and biorefineries, the costs of transporting biomass greater distances rises rapidly and can render any savings from reduced per gallon capital expenditures as unfeasible. Further, higher capital costs increase perceived project risk and reduce the likelihood of obtaining investment funding.

Recommendation: Additional needs include development of technologies with economics for early-stage plants that attract capital investment for subsequent expansion of similarly designed facilities. This targeted government investment in R&D and process optimization (in addition to stable and supportive policy) will enable the new industry to grow and prosper successfully.

Potential Solutions:

Discovery of solutions will require additional R&D in technology areas that allow significant reductions in the capital and operating costs of producing advanced biofuels and bioproducts. Research investments should be pursued that can demonstrate a capital and/or operating improvement that will allow the displacement of oil on a cost-competitive basis, including a reasonable return on capital. Research in the following areas within the conversion sector will help to address barriers:

- *Pretreatment:* Pretreatment technologies are needed that can efficiently convert the feedstock into a higher concentration of sugars; the sugars must be derived from a process that has relatively low capital costs, that minimizes sugar degradation, and which creates inhibitory by-products.
- *Fermentation:* Capital costs for industrial fermentation of structural carbohydrates are excessive relative to capital costs for first-generation ethanol, biodiesel, and petrochemically derived chemicals. Fermentation needs to be viable in low-cost simple tanks with minimal aeration instead of highly specialized fermentation vessels. Organisms need further improvement to handle a wider variety of feedstock hydrolysates, to utilize a variety of sugar types (i.e., glucose, sucrose, xylose, arabinose, etc.), and to be more robust to impurities in the hydrolysate.
- *Thermochemical Catalysis:* Compared to the knowledge that exists for converting petrochemical feedstocks, there is not a solid understanding of catalytic conversion of biomass feedstocks. There is a lack of knowledge about how reactions occur on the

surface of catalysts and how to limit the fouling and deactivation caused by impurities—regardless of whether the catalysis is based on deoxygenation, hydrogenation, hydrogenolysis, decarbonylation, or other chemistries. Biomass conversion systems are also more complex because of the predominance of water in the process systems. The attraction of these processes is that lignin can be utilized in addition to other feedstock components. There is warrant for expanded research to better link biomass processing with petrochemical processing.

- *Separations:* Separation processes are particularly difficult and costly because of the high amounts of water involved in biomass systems. Product concentrations in the hydrolysate are often lower than in petroleum systems. There is a need to develop new membrane technologies, novel molecular recognition systems, or other recovery strategies to significantly reduce capital and operating costs.

Priority should go to technology investments that can significantly reduce the capital and operating costs of advanced biofuels and biochemicals. This should include funding additional basic research, targeted research on specific elements of processes, and programs that address operational issues of early pilot and/or demonstration facilities.

Recommendations from 2013 (still valid):

- Support research on specialty and high-value co-products derived from biomass to enable the production of fuels.
- Support research on novel separations technology to help lower capital costs. Facilitate research on separations and other core processes that would reach several technologies, have a significant impact on the industry, and improve yields. Refine thermochemical catalysis, metabolic engineering and synthetic biology, and separations technologies.
- Develop new technologies that focus on enabling new molecules and conversion technologies focused on hydrocarbons such as biobased diesel and jet fuels. Develop fuels that are compatible with the existing delivery infrastructure.
- Optimize the loan guarantee processes to realistically recognize risk of new biofuels/bioproducts plants, and better coordinate USDA/DOE efforts.
- Support implementation of distributed facilities to perform preliminary processing with final conversion conducted at larger, more centralized refining facilities. This should reduce both capital and operating costs.

Additional Recommendations from 2014:

- In order to get a successful biofuels industry on line, we need both major policies to drive this forward (i.e., maintaining cellulosic RFS2 as originally enacted or others) and a major increase in R&D funding dedicated to crossing major technical barriers.

- DOE and USDA should do a periodic review of lignin technologies to ensure best processes in place.
 - Consider work in aromatics from lignin as potential opportunity.
- Need better consideration on integration on biofuels/chemicals on petroleum economy. Need to work with current petroleum producers and refiners to consider impact of increasing bioeconomy on traditional fossil-related industry.
- Integrated multi-year program plan among related federal agencies for bioenergy strategy. Agencies should coordinate to develop high-level, overarching plan that reflects each department's/agency's efforts and resources as well as activities to be leveraged.
- Nth plant economics are not realistic for driving early investment. DOE/USDA/Board agencies should show more realistic commercial progress in order to have a better picture of rate of return and make design cases relevant to the commercial scene. Need dynamic model to reflect risks and return of investment/hurdle rate adjustment over time.
- Need to drive down capital prices, which are the number one barrier to commercialization. Current technologies have inherently high capital costs. More funding should be focused on technology breakthroughs that would reduce capital costs long term.
 - Corn ethanol is \$2/installed gallon; cellulosic ethanol is approximately \$8–\$10/installed gallon. A reasonable target is \$4/installed gallon.
 - Consider how to intensify current processes.

Information Requests:

- Would like to have understanding of impact of BRDI work on advancing commercial state of art in biofuels and bioproducts (gallons produced, companies still in business, measurable data relevant to commercialization, etc.). To the extent possible, this should also be expanded to include all federal biomass funding.
 - Catalogue technology transferred from BRDI/federally funded projects to show success pattern.

Products, Markets, and Systems

Policy consistency over time and across agencies is important to enable supplies and markets to develop.

BRDI Recommendations:

BRDI funding is not consistent with the size of the problem and the benefits of success.

- BRDI should explore collaborations with other federal agencies (beyond just DOE and USDA) to better leverage its resources.
- BRDI should solicit proposals for work and increase public outreach efforts to demonstrate the current and potential societal benefits of the bioeconomy (job creation, reduced oil imports, greenhouse gas reductions, and positive regional impacts).

- Ensure that information is shared and that there are efforts to include underrepresented and disadvantaged communities.

Market Recommendations:

Research is needed to examine why higher ethanol blends are not being adopted more quickly in markets where they are allowed and where there is a large compatible fleet. The U.S. fleet has ~7% of its vehicles warranted for E85 and nearly 10% warranted for E15. These percentages are higher in states like Michigan that have more domestic vehicles and newer vehicles. Yet, according to DOE, fewer than 3,000 stations offer E85 and, according to “Choose Ethanol,” only 78 stations offer E15. If the percentage of higher blend-capable stations matched the percentage of higher blend-capable vehicles, there would be far more stations offering higher ethanol blends to the public. In particular, work is needed on the following:

- How to accelerate dispenser installation.
- What factors facilitated adoption in successful markets such as Brazil, Sweden, and Thailand. The research must identify policy differences and allocate success factors.
- Effects of potential policies on increasing adoption/penetration of alternative fuel use and infrastructure.

Bioproducts Recommendations:

Bioproducts are underexploited and could enhance fuel production if further developed and marketed. In the BRDI program, desirable actions are the following:

- Increase emphasis on approaches generating valuable co-products during the fuel-making process.
- Foster efforts that examine the effects of widening the Biopreferred Program to place more emphasis on bioproducts, adding new products to those covered by the program.
- Encourage administration to adjust the clause in the Biopreferred Program to restrict purchases to not only look at direct purchase cost per unit, but in addition, to consider the total cost of biobased products vs. petroleum-based products. This change could potentially be accomplished via an executive order.
- Examine how to recalculate the total cost of products for the purpose of federal procurement, e.g. by including the carbon cost on the traditional petroleum-based product.
- Create, maintain, and share widely a database of federally and privately developed bioproducts in order to inform federal and private initiatives. Non-federal examples include activities with national crop boards such as the Soybean Board and Corn Growers Association.
- Encourage more educational outreach on bioproducts with “show and tell” events in Washington, D.C. and elsewhere. This outreach would not be limited to the public sector but also include technology transfer showcases.

Feedstocks and Logistics

BRDI Specific

- Funding of biomass research analogy
 - Basic
 - Applied
 - Demonstration
 - Graphic needed.
- Independent analysis of DOE/USDA BRDI progress to date
 - Analyze how BRDI projects have filled gaps in the development of a biomass-based economy in the past and BRDI role in the future.
 - Determine to what extent they met their quantitative objectives and what products, patents, or processes in business use have resulted.
 - More communication and outreach of BRDI successes, maybe at Biomass annual conference.
- Examine (stand up) operating feedstocks supply chains (at scale) by region (development project with research components). Leverage existing pilot plant projects, particularly those that have received federal dollars (may need a market/consumer to be involved as a partner).
 - Land use
 - GHG
 - Rural development
 - Other model inputs
 - Identify markets
 - Integrates past work
 - Provide a timeline
 - Research to drive yields up and costs down.
- Support long term (at least five harvest cycles) field trials at scale for key biomass feedstock data.
- Require that biomass crop yield data from government-funded projects be posted to public databases such as the Bioenergy Knowledge Discovery Framework and Agricultural Research Service database.
 - Capture meta-data.
 - Still respect intellectual property considerations and regulations.

Feedstocks cannot yet be delivered cheaply and in large volumes.

- To achieve DOE goals of \$80/dry ton at the processing-plant gate, diverse feedstocks are needed as inputs for multiple intermediate products (cheap sugar, aromatics, fatty acids, terpenes)
- Give priority to feedstocks that are productive on low rent land and require minimal inputs of water, nutrients, and energy to achieve economically and environmentally sustainable yields. Consider adding biodiversity and ecosystem issues/language.

- Better utilize and maximize use of existing but underutilized feedstock resources (waste streams/agricultural residuals). Continue to build with biomass crops.
- Feedstock selection will be regionally dependent.
- Encourage farming systems that maximize productivity on existing agricultural land as “virtual acres” for biomass production.
- Understand the socio-economic drivers that influence land owner behavior. This will identify factors that will cause land owners to participate or not participate in producing energy crops.
- Explore ways to expand the land base for producing biomass to include tribal lands, military lands, other federal lands, reclamation lands, salinated lands, etc. (EPA Repowering America, Office of Science)
 - Still need to consider downstream conversion uses.

How different feedstocks give rise to different product yields and selectivities under a given conversion process is not understood.

- Better characterize the chemical and physical characteristics of feedstocks.
 - Understand how variation in nutrition, weather, and soil affect chemical composition, and how impacts of variation might be minimized.
 - Analyze the stability and composition in different environments for different feedstocks and define how we can control/tailor it. (More basic or fundamental research programs: Agriculture and Food Research Initiative, NSF, Office of Science)
 - Define acceptable range of variability for conversion
- Give priority to productive feedstocks that can be grown economically with minimal water, energy, and fertilizer inputs. No feedstock should be excluded as long as it can show it meets volumetric needs.

The full value of the feedstock is not yet captured.

- Achieve zero waste: No carbon left behind
- Identify broad and diverse ranges of potential valuable co-products.

Supply feedstocks for near drop-in fuels at scale.

- Need productive crops or algae that produce oils in their vegetative tissue to supply near drop in fuels for diesel and jet fuels.

VIII. Closing Comments

Meeting was adjourned.

Attachment A: Committee Member Attendance—August 19–20, 2014

Co- Chairs	Affiliation	Attended?
Kevin Kephart	South Dakota State University	Yes
Pamela Reilly Contag	Cygnnet Biofuels	Yes

Members	Affiliation	Attended?
Dean Benjamin	NewPage Corporation	Yes
David Bransby	Auburn University	No
Paul Bryan	UC-Berkeley	No
Steve Csonka	Commercial Aviation Alt. Fuels Initiative	Yes
Claus Crone Fuglsang	Novozymes North America, Inc.	Yes
Joseph James	Agri-Tech Producers, LLC	Yes
Randy Jennings	State of Tennessee	Yes
Coleman Jones	General Motors	Yes
Craig Kvien	University of Georgia	No
Kit Lau	BioAmber Inc.	Yes
Johannes Lehmann	Cornell University	No
Stephen Long	University of Illinois	Yes
Maureen McCann	Purdue University	Yes
Bruce McCarl	Texas A&M	Yes
Christine McKiernan	BIOFerm Energy Systems	Yes
Ray Miller	Michigan State University	Yes
Neil Murphy	State University of New York	No
David Nothmann	Battelle	Yes
William Provine	Dupont	No
James Seiber	University of California	Yes
Abolghasem Shahbazi	North Carolina A&T State University	Yes
Don Stevens	Cascade Science and Tech. Research	Yes
John Tao	O-Innovation Advisors LLC	Yes
Valerie Thomas	Georgia Tech	No
Alan Weber	MARC-IV Consulting / Weber Farms	No
Todd Werpy	Archer Daniels Midland Company	No

Total: 19 of 28 members attended

Attachment B: Agenda—August 19–20, 2014

Day 1: Technical Advisory Committee Meeting: Tuesday August 19, 2014

8:00 a.m.–8:30 a.m.	<i>Breakfast (to be provided for Committee)</i>
8:30 a.m.–8:40 a.m.	<u>Introduction and Welcome</u> <i>Committee Co-Chairs</i>
8:40 a.m.–9:10 a.m.	<u>Presentation:</u> DOE Update on Biomass R&D Activities <i>Elliott Levine, DFO, U.S. Department of Energy</i>
9:10 a.m.–9:30 a.m.	<u>Presentation:</u> USDA Update on Biomass R&D Activities <i>Todd Campbell, U.S. Department of Agriculture</i>
9:30 a.m.–10:15 a.m.	<u>Presentation:</u> Overview of DOE Bioenergy Technologies Office Multi-Year Program Plan (MYPP) <i>Amy Schwab, National Renewable Energy Laboratory—Systems Integration</i>
10:15 a.m.–10:30 a.m.	<i>Break</i>
10:30 a.m.–11:30 a.m.	<u>Panel:</u> Biomass Products <ul style="list-style-type: none">• <i>Dr. Brent H. Shanks, Director, National Science Foundation Engineering Research Center for Biorenewable Chemicals (CBiRC), Iowa State University</i>• <i>Bill Tittle, Nexant, Renewable Chemicals & Materials Opportunity Assessment Report</i>
11:30 a.m.–11:45 a.m.	<u>Public Comment</u>
11:45 a.m.–12:45 p.m.	<i>Lunch (to be provided for Committee)</i>
12:45 p.m.–1:15 p.m.	<u>Presentation:</u> Instructions for Subcommittee Breakouts <i>Committee Co-Chairs</i>
1:15 p.m.–5:30 p.m.	<u>Subcommittee Breakouts</u>
5:30 p.m.	Adjourn Day One

Day 2: Technical Advisory Committee Meeting: Wednesday August 20, 2014

8:00 a.m.–8:30 a.m. *Breakfast (to be provided for Committee)*

8:30 a.m.–10:30 a.m. Subcommittee Report-Outs

10:30 a.m.–10:45 a.m. *Break*

10:45 a.m.–11:45 a.m. Closing Comments and Next Steps
Committee Co-Chairs

11:45 a.m.–12:00 p.m. Public Comment

12:00 p.m. Adjourn Day Two