

Biomass Research and Development  
Technical Advisory Committee  
2016 Recommendations

December 5, 2016

# Contents

Introduction.....	1
Implementation and Conduct of the Biomass Research and Development Initiative .....	1
2016 Recommendations on the Bioeconomy .....	3
Key Themes and Problem Statements .....	3
Recommendations .....	4
Recommendations to Improve Profitability and commercial Viability of the Bioeconomy Industries .....	4
Recommendations to Develop and Support Market Drivers of the Bioeconomy .....	7
Recommendations to Stimulate Public Awareness and Support .....	7

## Introduction

The Technical Advisory Committee (the Committee) for the Biomass Research and Development Initiative (BRDI) was authorized through section 9008(d) of the Food, Conservation, and Energy Act of 2008 and re-authorized in the Agricultural Act of 2014. In section 9008 (d)(3)(B), the Committee is obligated to evaluate and make recommendations to the Biomass Research and Development Board to ensure that

- Funds authorized for the BRDI are distributed and used in a manner that is consistent with the objectives, purposes, and considerations of the Biomass Research and Development Initiative [§(e)(2)].
- Solicitations are open and competitive, with awards made annually.
- Objectives and evaluation criteria of the solicitations are clearly stated and minimally prescriptive with no areas of special interest.
- The points of contact [§(c)(2)(A)] are funding proposals under this title that are selected on the basis of merit, as determined by an independent panel of scientific and technical peers predominantly from outside the Departments of Agriculture and Energy.
- Activities under this title are carried out in accordance with the title.

## Implementation and Conduct of the Biomass Research and Development Initiative

The Committee's 2016 reporting obligations and recommendations for BRDI are as follows:

1. *Funds authorized are distributed and used in a manner that is consistent with the objectives, purposes, and considerations of the Biomass Research and Development Initiative.*

The Committee found that the funds were distributed and used appropriately. The 414 pre-applications received, 7 awards were made in 2016 and were consistent with the requirements of the Act.

2. *Solicitations are open and competitive with awards made annually.*

The Committee found that the combined fiscal year (FY) 2014 and FY 2015 solicitation was open and competitive, however, though the awards that have been made were open and competitive, awards have not been made annually. The Committee concurs with the decision to combine 2 years of funding (FY 2016 and FY 2017) because of the relatively small level of annual funds available. Combining two fiscal years is necessary at the current funding levels. Sufficient funding would allow BRDI to again make awards annually.

3. *Objectives and evaluation criteria of the solicitations are clearly stated and minimally prescriptive, with no areas of special interest.*

The Committee is satisfied that the U.S. Department of Agriculture (USDA) National Institute of Food and Agriculture and the U.S. Department of Energy's (DOE's) Bioenergy Technologies Office are fulfilling this requirement.

4. *The points of contact [§(c)(2)(A)] are funding proposals under this title that are selected on the basis of merit, as determined by an independent panel of scientific and technical peers predominantly from outside the Departments of Agriculture and Energy.*

The Committee commends USDA-NIFA and DOE-BETO for the selection process they have implemented for BRDI.

The Committee recognizes that the pre-application review process effectively down-selects the number of proposals that will be considered during the full application process; however, the Committee recommends that DOE and USDA provide more feedback to applicants who were not recommended to submit a full proposal. Also, more transparency in the details of the pre-application selection process is needed.

5. *Activities under this title are carried out in accordance with the title.*

The Committee found that the activities are being carried out in accordance with the title.

The Committee makes the following additional recommendations for further improving BRDI:

- The goals of BRDI are important to the Billion Ton Bioeconomy Initiative supporting job creation, rural development, and national security. This importance should be reflected in meaningful funding levels. If the nation places a high priority on accelerating the development of a secure, biobased economy, BRDI will require appropriations that are similar to what was provided prior to the funding cuts (from the previous \$40 million annually) implemented in December 2012. Even after combining the appropriations from two fiscal years (summing to \$6 million), BRDI could fund only 5 awards out of 414 applications. BRDI represents an important translational portion of the federal research portfolio, and \$3 million annually will limit the progress of basic research toward strategic applications.
- 2017 will be the last year of BRDI funding unless it is reauthorized. The Committee recommends that funding for BRDI be reauthorized.
- BRDI should document how projects have impacted the commercial state of technology and the bioeconomy to better publicize the successes of the BRDI projects.
  - As per the Biomass Research and Development Act section[§(e)(2)]:

“The objectives of the Initiative are to develop

    - a. Technologies and processes necessary for abundant commercial production of biofuels at prices competitive with fossil fuels
    - b. High-value biobased products
    - c. A diversity of economically and environmentally sustainable domestic sources of renewable biomass for conversion to biofuels, bioenergy, and biobased products.”
- The Committee recognizes the planned efforts to streamline the application submission process. The Committee suggests that BRDI continues to reduce the time from proposal submission to award selection.

# 2016 Recommendations on the Bioeconomy

## Key Themes and Problem Statements

During Committee discussions in 2016, the Committee felt that key themes and problem statements from 2015, with minor adjustments to better convey the proper messaging, were still relevant and appropriate. These key themes and problem statements frame the Committee recommendations and apply to all bioeconomy stakeholders, including federal research and development (R&D) agencies and private industry. The revised 2016 key themes and problem statements are as follows:

### 1. *Key Theme: Improve Profitability and Commercial Viability of Bioeconomy Industries*

- **Problem Statement:** Costs attributed to biomass feedstocks in the bioeconomy value chain are too high, feedstock composition is too variable, and supplies are inconsistent for biorefinery operations. Low-cost feedstocks are available only in isolated cases. Feedstock producers must have sufficient confidence that economic returns will be realized and that they have access to risk-mitigation tools before they will commit to establishing new feedstock production systems.
- **Problem Statement:** The Committee has recognized each year since the 2013 report that capital and operating expenses for conversion facilities have been the primary factors limiting the growth of advanced biofuels and commodity bioproducts. Conversion facilities encounter substantially higher capital costs per gallon of capacity than do starch/sugar ethanol plants or conventional petroleum refineries, and they involve less-efficient unit operations than conventional refining. Higher capital costs increase project-completion risks, and, thereby, reduce the likelihood of obtaining investment funding from the private sector. Additionally, large petroleum companies are reducing commitments to ongoing biofuels ventures and are making virtually no new investments.

### 2. *Key Theme: Develop and Support Market Drivers of the Bioeconomy*

- **Problem Statement:** Feedstock value is insufficient—and potential market risks associated with switching or rotating to new dedicated feedstocks are too high—to convince producers to dedicate acres to biomass production. The risks associated with perennial small-seeded species are often high relative to the existing commodity crops that benefit from many decades of R&D investment. There are existing federal programs that help to cross that divide (e.g., the Biomass Crop Assistance Program and 508(h) Risk Management Agency); however, additional effort is needed.
- **Problem Statement:** The social, economic, and environmental benefits of the bioeconomy are not sufficiently understood, making it difficult to understand the true value of transitioning to a sustainable bioeconomy from a fossil-fuel-based economy. This lack of understanding also complicates policy decisions regarding incentives to support the bioeconomy.
- **Problem Statement:** More economic and risk-mitigation innovations for biorefineries, such as the Joint DPA Program with the Navy, are needed to buy down costs enough so the project Awardees (and their private-sector investors) can continue move forward.

- **Problem Statement:** Some regulatory and policy issues impede the growth of the bioeconomy. On the basis of production cost alone, biofuels cannot compete with low-cost producers, and, therefore, cannot displace their market share.

### *3. Key Theme: Stimulate Public Awareness and Support*

- **Problem Statement:** The benefits of the bioeconomy must be made evident to the public, elected officials, and policy makers. There are many other benefits of the bioeconomy beyond competitive replacement in petroleum markets. Without public support, the larger policy changes that are necessary for an expanded bioeconomy will be difficult to implement.

## **Recommendations**

The 2016 recommendations to the Board are as follows:

For each key theme, recommendations were developed in 2016. Also included in each section below are related 2015 recommendations to provide continuity and show the relationship with the 2016 recommendations.

### *1. Recommendations To Improve Profitability and Commercial Viability of Bioeconomy Industries:*

- Expand R&D to reduce feedstock, capital, operating costs, and risks; support efforts to increase yields, improve efficiencies, and innovate around bottlenecks.
- Take advantage of existing infrastructure.
  - In the current environment where small refineries are challenged, help foster public-private partnerships for ongoing, essential R&D to help integrate the existing petroleum industry with the bioeconomy (e.g., refining of bio-oil derived from pyrolysis).
  - Pulp and paper mills are biorefineries that are currently struggling in international markets and could diversify to produce new or additional bioproducts.
- Use existing and new programs focused on de-risking technologies and feedstock production.
  - Leverage existing USDA and DOE programs, such as crop insurance and BioPreferred program, and develop new programs in order to incentivize private investment and financing for feedstock supply.
- Enhance the ability to implement sustainable landscape design by emphasizing low-carbon-intensive crops and further considering nutrient and land-management best practices.
- Manage all research funding to maximize the efficiency of the entire biomass supply chain, including means to increase the harvest, storage & transportation logistics efficiency for biomass and bio-intermediates (e.g., biomass densification, stabilization, and standardization).
- For commercial-scale systems, breakthrough technologies are needed to reduce capital and operating costs.

- The Billion-Ton Bioeconomy will require novel and disruptive technologies to be commercially successful, and too little is known about specific, future breakthroughs. A request for information (RFI) on novel and disruptive technologies is advised by the Committee. The Committee recommends that the Board release a RFI (or similar mechanism) to solicit new information on these technologies and work with the Committee on future R&D areas for consideration.
- Increase research investments in smaller modular systems as another path to cost reduction. Leverage existing infrastructure to reduce costs, particularly in the area of product distribution.
- Better enable the approval and certification process of bio-replacements, either direct replacements or functional replacements (i.e., American Society for Testing and Materials). This can be done through better standardization of requirements across the value chain.
- Fund programs to reduce operating costs of biorefining processes, such as, technologies to aid in the depolymerization of recalcitrant forms of cellulose, heterogeneous and homogeneous catalysis, advanced enzymatic treatment, fermentation and separation technologies, bioproduct integration, and biorefinery process synthesis and analysis.
- Create a new formal network with an open-access environment to build upon and share knowledge, services, facilities, and capabilities to support the growth of the bioeconomy.
  - Leverage existing information and networks such as BIO, ATIP, and Biomass Board reports.

**Related 2015 Recommendations:**

- Encourage cropping systems that increase biomass productivity. For example, develop profitable cropping systems that include periods for cover crop production when primary crops are not being grown.
- Encourage the integration of technologies and pathways that use existing infrastructure (e.g., refineries, filling stations, storage and distribution infrastructure). Expanded research is needed to better integrate biomass processing in the petroleum industry and to incentivize petroleum companies to make investments in biofuels and bioproducts.
- Focus public R&D on feedstocks and production processes that require minimal inputs (e.g., water, nutrients, chemicals, and energy) to achieve socially, economically, and environmentally sustainable yields.
- Develop post-harvest processing and logistics systems that continuously provide feedstocks to processors. For example, develop and demonstrate improved feedstock logistics via better approaches to aggregating, processing, blending, and storage.
- Establish specifications, standards, and mature technologies to create a biomass feedstock industrial commodity. Specifications should include limits for water content, chemical composition, and purity. Inexpensive tools for high-throughput, rapid-screening technologies that measure specifications related to quality assurance must be developed.
- Fund and manage a greater number of smaller R&D projects to establish a balanced R&D portfolio that will identify disruptive technologies offering the greatest opportunities for cost reduction. Technological breakthroughs are especially needed in the following fields:
  - Feedstock densification, storage, and transport
  - Pretreatments of raw feedstocks
  - Fermentation
  - Thermochemical processes
  - Catalysis
  - Separations.
- Establish and fund advanced manufacturing innovation centers. Emphasize centers where teams of researchers and projects can be coordinated for further testing in an integrated process context.
- Fund projects involving integrated pilot/demonstration processes only when all of the components have been proven at a scale in which there is confidence that the integrated process will work, and only when process-integration issues are the final major risks to commercialization.
- Demonstrate individual unit operations up to the smallest scale necessary to predictably scale up for commercial purposes before attempting large-scale integration.
- Fund technologies at appropriate scale. Large-scale demonstrations and pioneer plants should be funded only if early indicators show that the costs and integration risks are all that remain to be established. Integrated demonstrations should be scaled up only if all components are known and proven.
- The government should develop advanced computational technologies on modeling and simulation of processes relevant to manufacturing of biobased products and fuels.



## *2. Recommendations To Develop and Support Market Drivers of the Bioeconomy*

- Support actions that enhance the growth of the bioeconomy, such as implementing the Renewable Fuel Standard mandate; increasing federal funding for research; and incentivizing use of bioproducts and biofuels and expanding the BioPreferred Program.
- Focus research on areas where we know the market is ready to accept and promote bioproducts/biofuels as they are available. Support initiatives for product and market development.
- Support emerging business innovation and development through collaborations, Cooperative Research and Development Agreements, shared equipment, and access to national laboratories via new programs such as the Small Business Vouchers Pilot.
- Use government purchasing power and authority to develop market pull in the current low-petroleum price, low-carbon price environment.
  - To improve the competitiveness of biofuels with fossil fuels, focus on promising biofuel and bioproduct market segments, including high-octane, biodiesel and renewable diesel, biochar, biochemicals, bioplastics, and aviation fuels.
- Create a global feedstock commodity market by identifying and promoting exports of feedstocks, biofuels, and bioproducts where market conditions are more favorable.
- Promote long-term stable policies to reduce market uncertainty and to de-risk investments required to grow the bioeconomy.

### **Related 2015 Recommendations:**

- The Department of Defense and General Services Administration should explore an increase in the number and duration of purchasing agreements for biofuels and biobased products.

## *3. Recommendations To Stimulate Public Awareness and Support*

- The bioeconomy requires a value proposition that is better understood and embraced by the public. Conduct analysis to determine a framework to characterize and quantify the job creation, economic, rural development, public health, national security and environmental benefits of the bioeconomy.
- Improve the science and understanding of indirect land use change.
- Assess the economic effects, such as wealth and job creation, rural development, and resource and supply diversity.

**Related 2015 Recommendations:**

- Provide incentives for the large, established companies to invest through focused efforts to build demand for biofuels/products.
  - Develop fuel products that are compatible with the existing infrastructure, including new technologies that focus on alignment with existing petroleum infrastructure—for example, the efforts currently under way to develop renewable diesel and jet fuels.
  - Enable biomass technologies to take advantage of underutilized infrastructure and established facilities. For example, co-locate biomass post-harvest processing facilities with existing conversion facilities that offer synergies with biomass.
- Research socioeconomic drivers that influence producer decisions about feedstock production. For example, determine how feedstock production for the bioeconomy affects biomass utilization for wildlife habitat, management of concentrated animal feeding operation drainage areas, production field waterways, and riparian buffer zones.
- Analyze on a national scale (in addition to local/regional tools development) the effects of optimizing land and resource use for farm sustainability.