Testimony of the Biomass Energy Research Association
ON BIOMASS ENERGY RESEARCH, DEVELOPMENT & DEMONSTRATION

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Department of Energy Fiscal Year 2011 Budget Appropriation
Submitted to the House Committee on Appropriations
Subcommittee on Energy and Water Development

March 19, 2010

SUMMARY

This testimony pertains to fiscal year 2011 (FY11) appropriations for biomass energy research, development, and demonstration (RD&D) conducted by the **Department of Energy (DOE) Office of Energy Efficiency and Renewable Energy (EERE)**, **Biomass Program (OBP)**. This RD&D is funded by the Energy and Water Development Bill, under Energy Supply and Conservation, Energy Efficiency and Renewable Energy. BERA recommends a total appropriation of **$360 million in FY11 for Biomass and Biorefinery Systems R&D**. This is an increase of ~$140 million over the U.S. Department of Energy request for FY11 for this programmatic area. Specific lines items are summarized below (also see Table 1).

- **$30,000,000** for **Feedstocks** (regional partnerships, high yield feedstocks, simpler/cheaper algae routes)
- **$130,000,000** for **Conversion Technologies**, distributed as follows:
  - *$50,000,000* for **Biochemical Conversion** (emphasis on low cost sugars, advanced fuels, traditional plus non-traditional conversion routes, e.g., aqueous processing, chemical catalysis)
  - *$80,000,000* for **Thermochemical Conversion** (conversion to oils, long chain hydrocarbons, or other fuels/intermediates via pyrolysis, gasification, and non-traditional routes; low cost reactive intermediates such as CO and hydrogen)
- **$100,000,000** for **Integrated Biorefineries. (Systems integration, risk reduction through t**echnology demonstrations, sustained support for first-of-a-kind projects).
- **$20,000,000** for **Sustainability and Analysis** to assess life cycle impacts.
- **$80,000,000** for **Biopower** for pilot scale RD&D on decentralized applications; studies to assess cost, environmental impacts, and permitting issues; RD&D to address performance and other issues for larger scale boiler repowering.

BACKGROUND

On behalf of BERA's members, we would like to thank you, Mr. Chairman, for the opportunity to present the recommendations of BERA's Board of Directors for the high-priority programs that we strongly urge be continued or started. BERA is a non-profit association based in the Washington, DC area. It was founded in 1982 by researchers and private organizations conducting biomass research. Our objectives are to promote education and research on the

economic production of energy and fuels from biomass, and to serve as a source of information on biomass RD&D policies and programs. BERA does not solicit or accept Federal funding.

Table 1. FY 2011 Biomass &Biorefinery Systems R&D, Energy Supply & Conservation, DOE/EERE Biomass Program (Million Dollars)		
Program Area	**Description of RD&D**	**Total**
Feedstocks	- Regional feedstock partnerships - Research to improve energy crops, including super high yields: achieve 10 to 25 dry tons/acre/year via R&D compared with the 2 to 7 dry tons/acre/year possible today - Plants species amenable to thermochemical (e.g., high lignin) and biochemical (e.g., more easily processed lignin) processes - Simpler, less expensive algae production	$30.0
Conversion Technologies: Biochemical	- Conversion to next generation biofuels/processes (broader range of liquid fuels beyond ethanol) - Reduction of sugar costs through cheaper enzymes and other routes - Non-traditional technologies such as aqueous phase processing, chemical catalysis	$50.0
Conversion Technologies: Thermochemical	- Next generation biofuels and processes that can use a range of feedstocks (pyrolysis, gasification, other routes) - Low cost reactive intermediates such as CO and hydrogen - Synthetic routes to expand beyond Fischer-Tropsch fuels	$80.0
Integrated Biorefineries	- Risk reduction through demonstrations of biochemical and thermochemical conversion technologies in biorefineries, sustained support for first-of-a-kind projects, and underwriting of loan guarantees	$100.0
Analysis and Sustainability	- Life cycle analysis of new technology pathways - Land use issues	$20.0
Large Scale Biopower	- RD&D at pilot scale for decentralized biopower applications - Studies to analyze cost, permitting, and environmental issues	$80.0
TOTAL		$360.0

There is a growing urgency to diversify our energy supply, develop technologies to utilize indigenous and renewable resources, reduce U.S. reliance on imported oil, and mitigate the impacts of energy on climate and the environment. The benefits are many – economic growth, new American jobs, enhanced environmental quality, and fewer contributions to climate change. Economic growth is fueled and sustained in large part by the availability of reliable, cost-effective energy supplies. A diversified, sustainable energy supply is critical to meeting our energy challenges and maintaining a healthy economy with a competitive edge in global markets. Biomass can diversify U.S. energy supply in several ways:

- Biomass is the single renewable resource with the ability to **directly replace liquid transportation fuels.**
- Biomass can be used as a feedstock to **supplement the production of chemicals, plastics, and materials now produced from crude oil**.
- Gasification of biomass produces a syngas that can be utilized to **supplement the natural gas supply, generate electricity, or produce fuels and chemicals.**
- Biomass can be used directly or in combination with coal to **diversify our electricity supply**.

While biomass will not solve all our energy challenges, it can certainly contribute to the diversity of our supply, and do so in a sustainable way, while minimizing impacts to the environment or climate. Goals could be to reach at least the 10% to 15% levels in both the electricity generation and motor vehicle transportation sectors by the 2020 to 2030 decade, up from on the 1% to 25% levels today in these two sectors. Unlike solar and perhaps wind, biomass will be constrained to far below 100%, due to land use and water availability concerns. However, biomass can be developed from a minor role to a major role in a diversified, domestic and renewable energy supply for the United States, based on an expansion of our nation's agriculture and forest products industries. The Energy Independence and Security Act (EISA) of 2007 mandates increased use of alternative fuels, with a substantial portion to come from cellulosic biomass. A federal Renewable Portfolio Standard (RPS) is now under consideration (many States have already passed such legislation) which would increase the use of renewables for electricity, including biopower. To meet the EISA goals and potentially a federal RPS will require aggressive support for RD&D to move technology forward and reduce technical and economic risk.

OVERALL BERA RECOMMENDATIONS FOR US DOE/EERE BIOMASS RD&D

1. **PURSUE A BALANCED APPROACH TO BIOMASS R&D [All R&D Areas]** It is important for DOE to pursue a balanced approach to biomass R&D. This means striking a balance between the involvement of national labs, academia, and industry to take advantage of their distinctive strengths, rather than relying heavily on national laboratories, as in the past. The DOE should also pursue a balance between understanding fundamentals, advancing the technology, applying the technology, and integrating the technology. There has been a particular neglect of understanding fundamentals to provide a technology platform that would catalyze development of better technologies and enhance commercial success. Technology breakthroughs are needed because the scale (large) and the costs (too high) are barriers for the technology development pathways needed to meet today's energy and climate challenges. Mechanisms are needed to ensure that fundamental research and new processes and science get into the hands of the companies most likely to deploy the breakthroughs.
2. **MAKE INVESTMENTS TO BRING DOWN THE COST OF SUGARS FROM BIOMASS. [Biochemical and Thermochemical Conversion R&D]** One key to competiveness is reducing the cost of producing reactive intermediates from biomass. For biological systems, this means getting low cost sugars, as expensive sugars result in expensive products whether the product is ethanol or an advanced, infrastructure-compatible (drop-in) fuel. Making a drop-in fuel from expensive sugars is a pathway for

failure. Similarly, for thermochemical approaches, the key is getting low cost reactive intermediates such as CO and hydrogen. The balance advocated in Item 1 can help reduce the cost of making such intermediates. Include advanced biological routes that better integrate simplified combined biological methods with pretreatment to reduce enzyme costs dramatically, as enzymes followed by pretreatment are the major cost items that are susceptible to change.

3. **PROVIDE SUPPORT FOR BOTH TRADITIONAL AND NON-TRADITIONAL CONVERSION ROUTES [Conversion Technologies]** We recommend that while both biological and thermochemical processes be funded, greater emphasis should be given to thermochemical conversion for transportation fuels and substitutes for other petroleum-derived products to mitigate our dependency on imported oil. Thermochemical technology has been historically under-funded despite its potential to produce more infrastructure-compatible fuels. Biofuels R&D should be expanded beyond just ethanol and Fischer-Tropsch products. We advocate funding for chemical catalysis (rather than just fermentation) to broaden the spectrum for products from sugars; new catalysts and synthetic routes are needed. In addition to the traditional focus of biological and thermochemical routes, it is important to support new emerging technologies such as aqueous phase processing of biomass to diesel and jet fuel substitutes.
4. **REDUCE THE RISK OF NEW FUEL PRODUCTION TECHNOLOGY VIA DEMONSTRATIONS, LOAN GUARANTEES, AND SUSTAINED SUPPORT FOR FIRST-OF-A-KIND PROJECTS [Integrated Biorefineries]** It is important that DOE and the Congress understand the substantial challenges of introducing new fuel production technology, particularly in a market with large swings in prices. A fortune can be made when oil prices are high – and twice as many fortunes lost when they drop. A key approach is for DOE to "buy down" risk in a meaningful way to compensate for the huge fluctuations, and enable a few first-of-a-kind projects to succeed. DOE must also provide sustained support and avoid dropping projects prematurely. Technology demonstrations reduce technical and economic risk and accelerate the potential for private investment. A high level of guarantee is vital – as introducing any new fuel in today's petroleum-heavy market is extremely challenging. The capital costs for petroleum processing are paid off, making it a cash producer, while a biofuels facility must cover not only cash costs but make a high return on capital to compensate for first time risk. This is a heavy lift for first-of-a-kind technology.
5. **PURSUE SIMPLER AND LESS EXPENSIVE SYSTEMS FOR UTILIZING ALGAE [Feedstocks].** Much simpler and less expensive systems are needed, especially to harvest algae. This technology advancement should be pursued before other any new large scale projects are initiated.
6. **INCREASE SUPPORT FOR HIGH YIELD FEEDSTOCKS.** The cost efficient production and handling of energy crops—which is necessary for any significant impact on our national needs—continues to be a major cost and issue. However, it historically has been given a disproportionally small portion of funding.
7. **CONDUCT RD&D TO ENABLE GREATER USE OF DECENTRALIZED BIOPOWER.** A substantial increase over the requested $50 million should be made to support hands-on, applied RD&D to accelerate use of biopower. The bulk of these funds should go to RD&D rather than paper studies. Research activities of at least a pilot scale are a priority. While expensive, these are where the real path to commercialization happens.

Biopower RD&D activities should emphasize decentralized generation (5-50 MW), which plays to biomass's strengths (flexibility in delivery, broad applicability, localized/sustainable power) and environmental benefits (less transmission lines, less fuel hauling, less intrusiveness, more efficient/CHP). Biomass can also be pursued for centralized generation (large power) as a strategy for reducing greenhouse gases, and may be more attractive than other renewables as it is readily available and can be combusted much like coal. Large power uses may have a role for building biomass fuel supply infrastructure via fuel supplies developed locally with low capital cost because the coal plant is already built. RD&D could potentially focus on performance issues related to re-powering boilers with biomass.

8. **CONDUCT STUDIES NEEDED TO ASSESS COST, PERMITTING, AND ENVIRONMENTAL ISSUES RELATED TO BIOPOWER.** Studies are needed to inform industry, Congress, and the general public, but should not be the primary focus of biopower efforts. The cost and time for permitting of plants is already a significant factor in biomass industrial use and is growing. Permitting processes should be reviewed with a goal of facilitating industry growth by making permitting as simple, quick, and reasonable as possible. Regulators and companies need to be confident that they can obtain permits for biomass power or fuel plants. A scoping study of potential technologies meeting near-term scale-up potential or useable in retrofitting existing facilities could be useful, if it facilitates permitting or building of plants or retrofits. Detailed cost estimates for potential power generation and biomass conversion facilities could stimulate serious consideration from the business community raise awareness of successful DOE projects. Assessment of potential GHG emission reductions is needed to clarify the impacts on fossil energy and fossil CO2 that result from biomass crops, harvesting, energy from forests, etc., and moving to power plants. The goal is a fair net CO2 and net energy reduction value compared to fossil alternatives.
9. **LEVERAGE RESULTS FROM EXISTING/ONGOING WORK ON BIOMASS to SUPPORT BIOPOWER EFFORTS.** Cost-benefit analysis on feedstock type and delivery systems, for example, is not entirely unique to power and similar studies conducted for biomass feedstocks and biofuels can be leveraged to understand the biopower landscape.