National Agricultural Research, Extension, Education and Economics Advisory Board

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REPORT AND RECOMMENDATIONS OF THE NATIONAL AGRICULTURAL RESEARCH, EXTENSION, EDUCATION AND ECONOMICS (NAREEE) ADVISORY BOARD - RENEWABLE ENERGY COMMITTEE

October 2011

EXECUTIVE SUMMARY

The Renewable Energy Committee (REC) of the NAREEE Advisory Board was established in 2008 and charged to study the scope and effectiveness of research, extension and economics programs within the United States Department of Agriculture (USDA) Research, Education and Economics (REE) mission area.

The 2011 report acknowledges the work captured in the Office of the Chief Scientist Bioenergy White Paper collectively authored by the Bioenergy Science Team. The REC used the Office of the Chief Scientist Bioenergy White Paper and specifically the *Strategic Approaches Needed* as a framework for the 2011 annual report. As described in the white paper emerging bioenergy systems hold the promise of helping to reduce our dependence on foreign oil, increase rural wealth, and reduce greenhouse gas emissions. The REC developed the following recommendations to enhance, expand and support USDA/REE's emphasis to develop transformative ecologically based agricultural systems that ensure sustainable environmental, economic, and social outcomes:

- **USDA/REE should determine where funding is needed and reallocation is necessary without duplication, and emphasize accountability for renewable energy project funding;**

- **USDA/REE should determine the advantages and disadvantages of all feedstock production systems relative to land use and regionalization;**

- **USDA/REE should ensure that there is an agriculture information base relevant to renewable energy both to benchmark current status and to assess changes in feedstock production systems and other renewable energy-related systems resulting from agriculture production.**

- **USDA/REE/ National Institute of Food and Agriculture (NIFA) should adopt a public relations strategy to communicate research, education & economics accomplishments to the general public in applicable and practical terms;**

- **USDA/REE should consider emerging feedstock production systems including algae in the bioenergy supply chain; and**

- **USDA/REE should expedite development of electronic and user-friendly tools such as, the Feedstock Readiness Level (FSRL) Tool to assist stakeholders in decision making, as well as businesses and producers in implementing best business practices.**

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Background

Title IX of the 2008 Farm Bill includes a range of authorities for renewable energy research and development. The Renewable Energy Committee (REC) of the NAREEE Advisory Board was established in 2008 and charged to study the scope and effectiveness of research, extension and economics programs related to renewable energy within the United States Department of Agriculture (USDA) Research, Education and Economics (REE) mission area. The REC met in December 2010 to fully understand the current scope of renewable energy work relevant to REE with assistance from Carmela Bailey (National Institute of Food and Agriculture, National Program Leader), Dr. Robert Fireovid (Agricultural Research Service, National Program Leader), Dr. Steve Schafer (Agricultural Research Service, Deputy Administrator), Dr. Jeffrey Steiner (Agricultural Research Service, National Program Leader) and the Office of the Chief Scientist Senior Bioenergy Advisor Donna Perla. The Committee discussed the legislative requirement to consult with the Department of Energy's (DOE) Biomass Research & Development Initiative Technical Advisory Committee **(**BRDI TAC), the work missing from the USDA REE renewable energy portfolio, the requirement to study the scope of REE related renewable energy programs and the vision of the Committee's 2011 annual report.

Periodic conference calls assessed direction, accountability, relevance and adequacy of academia, industry and stakeholder renewable energy programs and initiatives. The REC comments were subsequently captured in the Office of the Chief Scientist Bioenergy White Paper commissioned by REE Under Secretary Dr. Catherine Woteki, authored by the Bioenergy Science Team, presented and discussed at the full NAREEE Advisory Board meeting held in March 2011 in Washington, DC. Comments from the NAREEE Advisory Board and the REC were collated, thus providing a framework determining the current scope and effectiveness of research, education and economics related to renewable energy.

Carol Keiser-Long, Chair of the REC provided comments to the BRDI TAC quarterly meetings. In addition, the Chair and other REC members attended the Farm & Fuel Summit, Agricultural Research Service (ARS) Biomass Workshop, International Biomass Conference & Expo meetings throughout the year reporting back to the REC and to the NAREEE Advisory Board.

Subsequently, with the collaboration of the Bioenergy Science Team, the REC developed the following six recommendations to support USDA/REE's emphasis in bioenergy.

- **USDA/REE should determine where funding is needed and reallocation is necessary without duplication, and emphasize accountability for renewable energy project funding;**

- **USDA/REE should determine the advantages and disadvantages of all feedstock production systems relative to land use and regionalization;**

- **USDA/REE should ensure that there is an agriculture information base relevant to renewable energy both to benchmark current status and to assess changes in feedstock production systems and other renewable energy-related systems resulting from agriculture production.**

- **USDA/REE/ National Institute of Food and Agriculture (NIFA) should adopt a public relations strategy to communicate research, education & economics accomplishments to the general public in applicable and practical terms;**

- **USDA/REE should consider emerging feedstock production systems including algae in the bioenergy supply chain; and**

- **USDA/REE should expedite development of electronic and user-friendly tools such as, the Feedstock Readiness Level (FSRL) Tool to assist stakeholders in decision making, as well as businesses and producers in implementing best business practices.**

The Energy Independence and Security Act (EISA) calls for the production of 36 billion gallons per year of renewable fuels by 2022 and establishes new categories of renewable fuel, each with specific volume requirements and life cycle greenhouse gas (GHG) performance threshold standards (Energy Independence and Security Act [EISA], 2007).[1],[2] As mandated by EISA, the Renewable Fuel Standard was implemented in 2009. Additionally, the Food, Conservation, and Energy Act of 2008 authorized a number of bioenergy research, demonstration, and deployment efforts being implemented by USDA and DOE. The REC recognizes the efforts of other agencies such as DOE and encourages collaboration without duplication of current bioenergy efforts. Many other state and national initiatives are also exploring the use of biomass to produce high value chemicals, and biobased products, and heat and power (Becker and Lee, 2008). All of these applications increase demand for biomass production.

It is imperative that the USDA maintain a lead role in renewable energy development, research and outreach to the agricultural community, industry stakeholders and academic institutions. The USDA must also maintain a strong partnership with the U.S. Department of Energy and other state and federal agencies as we continue to develop technologies to meet the nation's energy demands. The President's Biofuels Interagency Working Group report *Growing America's Fuel* identifies USDA as having research leadership responsibility for the improvement of non-food biomass crops and woody species, and the development of sustainable production and management systems for farms and forests. The plan called for the establishment of five regional USDA Biomass Research Centers. The purpose for this USDA-led effort is to help ensure that dependable supplies of needed feedstocks are available for the production of advanced biofuels to meet legislated goals and market demand, and enable as many rural areas across the country as possible to participate and benefit economically.

The Biomass Research Centers serve to compliment and coordinate USDA Agricultural Research Service (ARS) and Forest Service Research & Development (FS) intramural research from across the country to

[1] 15 Billion Gallons per year of corn ethanol; 21 BGY of "advanced biofuels" with a 50% reduction in life cycle GHG emissions, compared to fossil fuels; 16 BGY of that coming from cellulosic sources with a required 60% reduction in life cycle GHG emissions. An addition one BGY of biomass-based diesel is also required.

[2] This national standard is expected to reduce greenhouse gas emissions more than 138 million metric tons a year when fully phased in by 2022

help accelerate the establishment of commercial region-based biofuel supply chains based on agricultural and forestry-based feedstocks. Most importantly, the USDA Regional Biomass Research Centers are networks of existing ARS and FS facilities and scientists located in research centers and more than 100 locations nationwide.

The Biomass Research Centers are in an ideal position to facilitate the much needed research and development needed to ensure the sustainability of both existing and emerging feedstocks. The Centers are also critical in building public-private partnerships that will help to leverage financial resources and foster investment of private interests. One example is a project in Louisiana to expand the Southern Regional Agricultural Sector by utilizing sweet sorghum and energy cane crops, capable of being produced in underutilized land, for the manufacturing of bio-based fuels and by-products. Formation of a multi-state, multidisciplinary consortium of agricultural scientists, biotechnologists, technology and engineering providers, economists and educators will facilitate conversion of these regionally appropriate crops into a portfolio of bio-based fuels and chemicals. Many private renewable energy and biomass interests are listed as partners in the project as well as the ARS Research Station in Houma.

The REC acknowledges the authors' extensive analytical assessment that contributed to the Office of the Chief Scientist Bioenergy White Paper, thus using the Office of the Chief Scientist Bioenergy White Paper as creditable documentation to suggest additional challenges, opportunities and leveraging of resources.

Successful bioenergy systems require strategic approaches, of which excerpts from the Office of the Chief Scientist Bioenergy White Paper are highlighted below. These necessary strategies pose many scientific research, economic, data management, and communication challenges. The REC suggests to enhance and to expand the *Strategic Approaches Needed* to recommend critical analysis and solution examples. Where current program resources are ineffective, allocation of those resources should be reallocated taking in consideration regionalization.

Office of the Chief Scientist Bioenergy White Paper Excerpts

- *A multi-disciplined integrated systems approach is needed.*
    - There should be a greater emphasis in the approaches to integrate biomass production into existing systems with increased intensity in identifying new co-products and bio-based products for the purpose of increasing cost efficiencies in biorefining. The Office of the Chief Scientist Bioenergy White Paper does not recognize ARS as doing research in this area; however, more defined research is needed with increased funding.
    - In order to meet the energy needs of the future, we must not consider a "one size fits all approach." A comprehensive vision must take into account the strengths and challenges of the regions and resources must be targeted.
- *Reliable availability of commercial-scale feedstocks and conversion technologies that are cost-competitive with fossil fuels are needed.*
    - Develop a matrix to illustrate sustainable feedstocks and conversion technologies regionally.
    - Take in consideration agronomic factors, regionalization and land use.
- *Increased feedstock production needs to be implemented sustainably – integrated with other agricultural production and uses of land, resources, economic systems, and communities*

- Ensure the most productive working agricultural, forest and grazing lands remain working lands.

- Identify new and emerging feedstocks including water-based systems that capture significant amounts of carbon and provide efficient and environmentally sustainable agricultural waste management benefits.

- *Strategic priorities and quantitative measures of success (i.e., performance goals, milestones, and critical decision points) need to be established and integrated databases and decision-support tools developed and provided to decision-makers and stakeholders.*

    - Develop an agriculture information base relevant to renewable energy both to benchmark where we are and to record changes in feedstock production systems and other renewable energy-related systems resulting from agriculture production. This data will be necessary to provide economic and environmental analyses of production changes.

    - Create a central, searchable database of biomass and other renewable energy resources to direct implementation of best business practices.

- *New multidisciplinary educational and research programs and new structures for outreach, extension, and workforce development are needed along the bioenergy values chain.*

    - Improving support for and addressing community concerns about renewable energy facilities and products.

    - Develop an energy mass balance equation to quantify all input and output products and amounts. Life cycle analyses are critical to understanding the long-term sustainability of the emerging algal-based biofuel industry. The REC proposes that a set of modeling tools and programs be developed to analyze the production of the algae biomass, processing systems, geographical locations, environmental impacts, as well as micro- and macro- economic effects. Through the development of these modeling tools and their integration into a single 'Geo-Environmental & Economic Process' (GEEP) model the entire life cycle of the products, and effects upon land use, fuel production, as well as social, economic, and environmental effects can be quantified and analyzed for impacts on sustainability in the development of algal derived fuels and bioproducts.

Noted in the Office of the Chief Scientist Bioenergy White Paper, REE agencies are taking a coordinated systems approach to inform the design of high yielding biomass production systems that aim to maximize economic, environmental and social benefits. Specifically, USDA REE is implementing the following strategies to overcome challenges:

1. Improve biomass quality and production efficiency to reduce production and biorefinery costs;

2. Incorporate biomass and dedicated feedstock crops and other clean bioenergy products into existing and new agricultural systems to increase diversity of the rural economy and sustainable land management to produce fuels, heat, power, and high-value chemicals in addition to food, feed, and fiber; and

3. Address the uncertainties of expanded biomass and biofuels production to achieve benefits and avoid negative impacts on rural communities, economies, ecosystem services, and food, feed, and fiber.

The REC agrees with the assessment of the previous strategies to overcome challenges yet recommend the following critical comments:

- Promote opportunities for producer and community partnerships of facilities and domestic manufacturing of renewable energy technologies; and

- Assess the need to develop an expanded network of existing pipelines, rail lines, ports and other shipping facilities, and new pipeline and shipping opportunities for renewable fuels and feedstocks.

As referenced in the FY 2010 Annual Report (NP 213 Bioenergy) the ARS Bioenergy Program is designed to generate the science and technologies which can ensure that these targets are fulfilled by the sustainable production of herbaceous energy crops, algae, and crop residues and by the conversion of these feedstocks into marketable fuels and value-added co-products. The fundamental structure of ARS Bioenergy Program consists of coordinated thrusts in three areas – feedstock development, sustainable feedstock production systems, and biorefining. Through these three components, the Program strives to ensure that bioenergy production is integrated into existing agriculture in ways that;

- Provide consistent, attractive returns to producers,

- Minimize adverse impacts on existing markets for food, feed and fiber, and

- Demonstrate good stewardship of soil, water and air resources.

ARS places a high priority on partnering with stakeholders in the entire bioenergy value-added chain (i.e., production, harvesting, collection, transportation, storage, fractionation, preprocessing, biorefining, and product marketing) so as to ensure that ARS research generates the widest impact in the shortest possible timeframe.

The accomplishments identified in the NP 213 Bioenergy are impressive; however, the Committee suggests:

- How are returns on investment measured to producers? Knowing the advantages and disadvantages of the feedstock production system components would determine success of the research accomplishment;

- Conduct a study of comprehensive infrastructure needs for the renewable fuels sector and recommend needed action to ensure delivery of renewable fuels and feedstocks to market; and

- A greater communication of these accomplishments through a public relations effort.

The REC complements ARS and the Bioenergy Program Leader Team with advancements in coordinating government and private efforts to accelerate aviation biofuels development. Strategic leveraging of agricultural research with other agencies' resources to bridge the feedstock supply chain system to sustainable product commercialization is a successful forward thinking response to the Bioenergy White Paper's *Strategic Approaches Needed.* Therefore, the REC endorses the Feedstock Readiness Level (FSRL) Tool and encourages USDA to expedite further development of electronic and user friendly tools to communicate biofuel, biopower and bio-based product status.

The utility of the Feedstock Readiness Level (FSRL) Tool is: communication between all supply chain participants (including government and private service providers); research and planning and coordination; measurable research, development and education progress towards commercialization and integration of all supply chain activities and programs. (as referenced in Jeff Steiner's presentation).

USDA is the most appropriate agency to develop more definition and increased opportunity for multi-disciplined integrated system approaches relevant to biofuels, biopower and bio-based products.

Summary

The REC agrees the Office of the Chief Scientist Bioenergy White Paper was well researched and well constructed not expressing specific opinions but capturing critical issues addressing research, education & economics relevant to bioenergy. The 2011 recommendations are in addition to the documented challenges and opportunities expressed in the Office of the Chief Scientist Bioenergy White Paper and in the FY 2010 Bioenergy Annual Report. Enhanced and expanded research and educational initiatives in renewable energy require additional funding or the reallocation of existing resources, which may alter current program priorities. USDA has a track record of successful research, education, and extension activities in the bioenergy supply chain of feedstock production systems, feedstock logistics, conversion, bioenergy distribution and bioenergy end use technology, already in place. Therefore, the REC believes that strategic capitalization on the successes should be used in allocation and reallocation of resources with emphasis on accountability, renewable energy information database, feedstock production regionalization, create tools to evaluate integrated system approaches, public relations strategy and emerging feedstock production systems.

REPORT DEVELOPED BY THE NAREEE ADVISORY BOARD – RENEWABLE ENERGY COMMITTEE

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