BIOMASS RESEARCH AND DEVELOPMENT
TECHNICAL ADVISORY COMMITTEE
2010 RECOMMENDATIONS

CROSS-CUTTING RECOMMENDATIONS

Data Accessibility

- Federal agencies should foster sharing of data from funded organizations to a greater extent through a variety of mechanisms including, but not limited to, conferences, periodic follow-up surveys, databases, tools, etc.

More RFS Pathways

- The departments should provide an assessment of more biomass/biofuel pathways to help EPA accelerate their certification of those pathways in order to eventually qualify towards meeting the RFS. The Committee believes the private sector will be reluctant to go forward with commercialization if their pathway is not assured status under RFS.

Biopreferred program

- USDA should expedite the approval of new materials eligible under the biopreferred program.

Success rates

- The Committee acknowledges that not all projects will ultimately succeed due to the high risks associated with unproven technologies. Although project failure should be managed where possible, it should not preclude the funding of new and innovative technologies by the Federal government.

Merit Review Process

- Federal agencies should seek continual improvement of the merit review process while ensuring fairness to all projects and staying focused on identifying the most promising ones. For example:
  - Consider a smaller number of compensated and highly-qualified reviewers to review proposals.
  - Construct solicitations to garner streamlined proposals that focus on technical and business aspects of a project, minimize redundancy and reduce forms, especially those that apply only if selected.

Integrating Large Scale Bioenergy Production with Food and Feed Production

- Existing agricultural and forestry systems were not designed with large scale bioenergy production as a goal. The agencies should conduct efforts to envision, study, and then implement sustainable systems that gracefully reconcile what appear to be competing demands for land to produce feed, food, fiber, and feedstocks for biofuels and biopower. The committee

notes that such efforts will likely require a significant increase in sustainable biomass output per acre. Some possible examples include:

- Winter crops and companion crops integrated into corn/soybean production.
- Increased output for existing pasture lands
- Sustainable harvesting of forests, forest residues
- More land efficient animal feeds and feeding systems to increase land available for bioenergy production
- Utilization of non-arable land with non-fresh water
- Utilization of alternative feeding strategies that will allow the most efficient use of crops and crop residues

FEEDSTOCK RECOMMENDATIONS

Woody Biomass

- Whereas federally funded research and development projects and Federal permitting have limited the utilization of woody biomass, strategies should be developed to encourage the utilization of woody biomass derived from federal, state, and private lands, including non-plantation private lands. Possible strategies include:
  - Federally funded projects, including R&D projects, should not exclude utilization of these feedstocks;
  - Stand establishment date (after enactment of EISA) should not be a factor in determining eligibility; however, studies should be conducted to determine appropriate restrictions needed to protect environmentally sensitive and old growth forests shall be restricted;
  - Studies should be conducted that will enable the creation of policies regarding long-term (10 year minimum) contracts for utilization of woody biomass from federal lands should be allowed.

Indirect Land Use

- Whereas the Committee observes that the impact of utilizing energy feedstock in the U.S. on land-use changes in other countries is greatly influenced by various assumptions, more sensitivity analysis, evaluation, and validation of the current indirect land use models needs to be done. Furthermore, all indirect land use models should be publicly available (i.e. transparent).
  - Example: The impact of rising prices on higher yields has been shown in the FAPRI model to potentially negate all land-use changes.
  - Further data used in these analyses needs to be current in order to be meaningful.
    - Example: Yield data used in the GTAP model is over 8 years old.

Environmental, Economic, and Social Impacts

- An effort should be put forth to quantify the environmental, economic and social impacts of increased biomass feedstock supply on a watershed, regional and/or eco-region scale moving

from small, replicated field plot trials to larger-size demonstration plantings. One example could be using the Regional Feedstock Partnerships to develop information on yield, sustainability, social issues, etc. of scaled-up biomass feedstock production, monetizing environmental services.

Food and Fuel

- Whereas opportunities for all crops to be used in biobased products should be explored, food and feed crops should not be excluded as feedstocks for conducting R&D for conversion to biobased fuels and materials.

Productivity

- Strategies to increase sustainable yield of second generation feedstocks need to include R&D on:
  - sequencing the genome of plants to identify new genes that will improve the productivity and sustainability of the crop
  - searching for yield enhancement, stability and resource use efficiency genes in model species such as Arabidopsis and Brachypodium;
  - developing transformation systems to utilize these genes;
  - breeding programs as part of an integrated effort to improve productivity;
  - public germplasm collections to facilitate the latter; and
  - high throughput screening technologies and facilities, particularly with respect of photosynthetic productivity.
- Geographically dispersed trials of potential energy crops and their sustainability need to be continued and expanded to allow prioritization of crops for further development. The Federal government should support collection and evaluation of germplasm for new energy crops.

MSW

Whereas MSW is potentially a valuable source of low-cost cellulosic feedstock that can be used for energy conversion and may be used synergistically with agricultural and forestry feedstocks by partially offsetting the relatively higher price of these materials; whereas several private companies are developing technologies to separate and process MSW into an environmentally acceptable cellulosic feedstock for production of energy; and whereas it is noted that no Federal agency is contributing to these and similar efforts, DOE, USDA and other Federal agencies should document work in the private sector on processing MSW for use as an energy feedstock and include that type of research in future feedstock solicitations.

Algae and other organisms

- Algae and other organisms could provide a significant source of biomass (including oils/lipids), and it is recommended that research and development be conducted on performance and economics of algae and other organisms as it relates to:
  - Carbohydrate/Polysaccharide production and utilization
  - Source of Biomass

- Source of Oils/Lipids
- Production and Processing
- Carbon Sequestration and Reuse

Improving Biomass Logistical Systems

- Investment is needed to improve the harvesting, transport, and logistics for large-scale bioenergy production so that adequate quantities of sustainable feedstocks will be available as conversion technologies are rolled out. Research and development priority should be given to pre-processing and logistical systems which can deliver very large quantities (~1 billion tons per year) of dense, uniform, stable, storable biomass feedstocks.

CONVERSION RECOMMENDATIONS

International technology

- Conduct a worldwide study of conversion technologies and incentives to accelerate technology deployment in order to assess the position of the United States relative to other countries and leverage promising technologies.

Separations technologies

- Conduct a review of the status of chemical and physical separations R&D, with the goal of identifying gaps and opportunities (e.g. hemicellulose and lignin, alcohol and water, etc.). Separations is an important cost element for both the front and back ends of the conversion process.

Scale of supply/conversion systems

- For different technology pathways using different feedstocks the optimal (energy, environment and socio-economics) size range of biomass conversion plants vary. The DOE and USDA, including the loan guarantee programs, should consider commercial plants as anything economically viable and sustainable and not impose a minimum or maximum size.

INFRASTRUCTURE RECOMMENDATIONS

Market Creation – General Approach

- In light of the progress that has been made in biofuel technology and production, it is critical that Federal resources be focused on research and policy efforts to create, stabilize, and mature markets for biofuels, specifically ethanol.
- Technological, timing, cost, and investment uncertainty concerning the future availability of fungible biofuels (drop-in biofuels) make further delay in market creation efforts for ethanol (and biodiesel) infeasible if U.S. economic, energy independence and CO_2 benefits are to be achieved. The promise of future commercially viable drop-in fuels should not be used to avoid needed infrastructure action on current biofuels for which technical solutions to growth constraints are known today.

Market Creation – Vehicles

- Agencies and Departments should be advised to harmonize vehicle emission, diagnostic and fuel economy test procedures for all commercial biofuel blend levels; low-level, mid-level, and high-level, based on the known physical properties of the blends. Required test fuels should match commercially available fuels to protect consumer interests. Immediate rule making should be undertaken to incorporate E10 fuels as emission and fuel economy test fuels with appropriate accommodation for their fuel properties. Certification fuels should be reviewed as time goes on to adjust the certification fuels to reflect commercially relevant blends.
- Research and development should be undertaken to assess economic impacts, purchaser decision impacts, effect on ethanol sales volumes, and overall impact on the car parc of making all or a higher portion of the vehicles produced and sold in the United States gasoline-ethanol blend flex-fuel vehicles (FFV). It is expected such action would accelerate the ability of the U.S. car parc to accept evolving blend levels over time.
- Research should be undertaken on the barriers to harmonize FFV technology with tailpipe/evaporative emission, fuel economy/CO_2, and onboard diagnostic (OBD) requirements administered by the EPA and the CARB in the U.S. Vehicles that are designed to work with varying blends have different regulatory interaction than vehicles designed to work with a single or small range of blends. The need for this accommodation is based on differences in the vapor pressure and boiling characteristics of low level gasoline ethanol blends and high level gasoline ethanol blends.

Market Creation – Non-Vehicle End Use Devices

- Research should be undertaken to understand the design requirements of establishing a minimum biofuel blend capability in non-vehicle end use devices (marine, outdoor power equipment, other).

Market Creation – Fuel Blends and Distribution

- Research should be undertaken to explore the barriers to implementing flexible fuel pumps that are capable of dispensing fuels to meet the design specification of all end use devices (vehicles, marine, outdoor power equipment).
- Research should be undertaken to explore the potential benefits of implementing technology and conducting education to prevent mis-fueling of end-use devices within the flexible fuel pump context.

Market Creation – Fuel Blend Pricing

- Research should be undertaken to identify methods that successfully encourage consumer selection of the highest biofuel blend available to them. This study should include flexible fuel pump configurations and consumer economic factors.

Market Creation – Post Bio-Refinery Infrastructure

- Research should be undertaken to establish the parameters of hydrocarbon fuel blend stock compatibility and feasible delivery/ transportation mechanisms that could support the flexible

fuel pump market model. This study must include fuel volatility compliance, tankage and transportation issues.

- USDA predictions are that biofuels production will be located mainly in the southeast and east central regions, while major fuel markets are in the west and northeast. The current transportation infrastructure is insufficient to accommodate the volumes of biofuels that will be produced. Research should be undertaken into the barriers and solutions of transporting biofuels from biorefineries to markets.

Biopower

- Research should be undertaken on the infrastructure needs and regulatory barriers of non-transportation biopower.
- Research should be undertaken to explore the optimal location and scale for optimal utilization of biopower plants.

Federal Trade Commission pump labeling

- The Federal Trade Commission pump labeling rule should not apply to advanced biofuels that are molecularly equivalent to their petroleum counterparts.

SUSTAINABILITY RECOMMENDATIONS

Direct Land Use Changes

- Direct land use changes such as pasture or CRP land to biomass crops should be estimated on a regional basis and the environmental impacts of such changes calculated.

Water Use/Quality

- Water utilization in the production of biofuel crops and in the production of biofuels has gained additional scrutiny in recent years. Enhanced and integrated research should be conducted by USDA, DOE, and EPA to better understand and compare water use at all stages of biofuels production and ways in which to conserve water, and maintain water quality, throughout this lifecycle.

Market/Economic Sustainability

- A sustainable renewable fuel effort requires that biofuels enter the market, are adopted by consumers, fulfill criteria to meet the renewable fuel standard, reduce imported fossil fuels and reduce carbon intensity. Research and development should be conducted in the following areas:
  - Biofuels as they blend with fossil fuels especially E20, E85
    - Emissions
    - Mile per gallon and/or cost per mile
    - Required infrastructure (see infrastructure recommendations)
  - Market research into consumer response and adoption of those blends
  - A consumer education program and/or platform to improve understanding of biofuels data. For example:

- Miles per gallon and/or cost per mile
- Environmental impact (e.g. Energy Star)

Resource Conservation

- The production, transport, processing and distribution of bio-energy feedstocks and products have a largely unknown impact on natural resources, especially on a specific geographic area's resources of concern. A comprehensive, coordinated and complete strategy for R&D should be developed to determine sustainability thresholds, establish sustainable production systems, and identify/implement best management practices.

Lifecycle Analysis

- USDA and DOE should institute a program to monitor and measure relevant environmental parameters for the current and expected feedstocks for biofuels, biopower and biobased products. These measurements should be made in different geographies and climates, and should remain in place for at least 5 years, to cover the impacts of weather variability. They should also be compliant with IPCC standards, such as the FLUXNET system. Further, USDA and DOE should update and maintain measurements of all crop/forest inputs and offtakes, including water use, utilizing contractors where necessary to obtain ample diversity. These should be collected and published as standardized Life Cycle Inventories (LCIs) available for public scrutiny. These LCI should be continuously updated and republished on at least a biannual basis.
- LCA assessments should include energy return on energy invested (EROI) estimates for biofuel and biopower systems, including both the agriculture/forestry production component and the biofuel/biopower conversion component. Such LCA studies should be conducted in sufficient detail to direct future research and development to improve EROI for biofuel/biopower systems.
- USDA and its contractors should partner with producer organizations and other stakeholders to verify the accuracy of the LCIs. LCAs based on these LCIs should be peer reviewed before acceptance as a basis for any regulatory or policy decisions.
- LCA studies done with USDA/ DOE support should be published in conformity with ISO's standards of transparency, system boundaries, allocation, etc.
- A priority list of feedstocks for GHG monitoring should be established in consultation with stakeholder groups. The list should include at minimum:
  - two or more woody biomass species under investigation for use as energy crops such as willow or poplar,
  - three or more perennial grasses under investigation for use as energy crops and at a minimum switchgrass, miscanthus and energy cane,
  - grain and oilseeds currently used for biofuel production such as corn, soybeans and canola
  - comparisons of residue removal/non-removal for corn stover and wheat straw, other alternative energy crops under investigation as combined sources of sugars and cellulose such as sugar beets, sugar cane, sweet cane/sorghum hybrids.
- Deployment of monitoring sites and data collection should begin as soon as possible, but no later than June 2012.

Social Sustainability

- A comprehensive study should be conducted on the potential social and economic impacts of the emergence of a biofuels, biopower, and biobased products economy as envisioned by the USDA Biofuels Roadmap. The study should:
  - Investigate the number and kinds of jobs created, the manpower required, the availability of that manpower in rural areas, and the likelihood and size of population shifts from urban to rural areas.
  - Estimate and project the consequential increase in demand for human infrastructure especially in rural areas- i.e. housing, education, healthcare facilities, communication, police and fire protection, etc.
  - Estimate and project the consequential need for transportation infrastructure for both the movement of biomass and the movement of the increased population- i.e. roads, bridges, rail, highway, air service, power lines, natural gas and fuel transmission, etc.
  - Develop a comprehensive plan at the federal level and communicate anticipated needs to state governments and agencies which will bear the brunt of these changes.
  - The study should include research and analysis into the appropriate size of biomass based businesses and industries for the economic, natural, and social resources in the area.
- Further, the impacts, both positive and negative, of such changes on the current business community should be studied. Such a study should try to address such questions as:
  - How to maximize opportunities for rural economic development utilizing business and technology systems that encourage local ownership of biofuel, bioenergy, and bioproduct systems?
  - Will existing agricultural supply and agricultural processing be negatively impacted? If acres switch from grain to biomass will the local grain elevator lose business and ultimately close? The same could be asked for a myriad of businesses tied to local agriculture.
  - Will competition for labor increase wages in rural communities forcing some marginal businesses to close?