

United States Senate
Committee on Agriculture

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Mr. Chairman and Members of the Committee, thank you for the opportunity to discuss the energy title of the farm bill. I am Steven Slack, Associate Vice President for Agricultural Administration and Director of Ohio Agricultural Research and Development Center at the Ohio State University and speaking today on behalf of the North Central Bio-economy Consortium.

The North Central Bio-economy Consortium (NCBEC) is a 12-state collaborative effort between the directors of the State Departments of Agriculture, Cooperative Extension Services and University Agricultural Experiment Stations. Together these three institutions from the states of Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin have pledged to work together to guide our North Central region and the nation to greater use of bio-based fuels, energy, and products.

Each organization in the Consortium has agreed to contribute funding to the operation of the Consortium, and a private foundation - The Energy Foundation - has provided matching funding. The Great Plains Institute is partnering with the Consortium to provide staffing and facilitation. The North Central Bio-economy Consortium has also recently agreed to collaborate with the Midwest Governor's Association on policy review and development for a proposed Energy Summit to be held later this year.

Members of the Consortium are making considerable efforts to partner with industry as well. As just two examples, Conoco-Phillips recently announced it will fund a \$22.5 million biofuel research program at Iowa State University. BP recently announced it will fund a \$500 million joint biofuels research program - the Energy Biosciences Institute - involving the University of California at Berkeley, Lawrence Berkeley National Laboratory and the University of Illinois at Urbana-Champaign.

Our 12 North Central states already lead the nation in biofuel production and have the potential to lead the nation in producing other biomass feedstocks for the next generation of cellulosic biofuels and bioenergy (including feedstock materials such as switchgrass, crop residues, woody crops, mill residues and wood residues).

We believe the potential to use multiple biomass feed stocks for cellulosic bioenergy

development casts the region into a leadership role as Congress considers federal farm policy that will help shift the nation's energy reliance away from unstable foreign sources.

Although this effort currently focuses on one region in the United States, we believe that our efforts will benefit the entire nation. As we continue down the path towards greater energy independence from the use of bio-based feedstocks to supplement limited supplies of fossil fuels, the Consortium hopes to advance general knowledge about processing technologies, crops, economics and logistics that will be useful nation-wide. We hope that our model of collaboration may be useful in dealing with other challenges the nation may face in the future.

Importance of the Consortium

The NCBEC is working to coordinate the efforts of all the major state-level public sector entities that serve agriculture, and is the first effort of its kind. The combination of leadership and policy from the State Departments of Agriculture with research and education from the land grant system creates an effective mechanism for helping to manage an agriculture sector revolution.

The challenge that a rapidly-growing bio-economy represents is the sort of challenge that the Land Grant system was designed to handle. The Land Grant institutions in the North Central region already have extensive research and extension programs dedicated to the bio-energy challenge, and are working to expand this work as resources allow.

The rationale for forming a regional Consortium is that the 12 North Central States in the NCBEC are the hub of the growing U.S. bio-energy industry: the region contains 112 out of 115 existing ethanol plants, as well as 64 out of 79 currently under construction. Nearly 90% of ethanol production capacity - including both existing plants and plants currently under construction - will be in the North Central states.

The North Central region is also likely to play a strong role in developing new biofuel resources - particularly our nation's cellulosic biomass resource. According to two studies, the North Central states contain around 50% of the nation's cellulosic biomass resource, including more than 70% of the nation's perennial energy crops and crop residues.

Many members of the Committee represent states outside of our region, and we look forward to finding opportunities to partner with State Departments of Agriculture, Land Grant Universities, and other partners in your states. The great promise of cellulosic biofuels is that they can be produced from whatever cellulosic material is best suited for your region. Just as the Consortium sees the value in better regional coordination and information sharing, we hope to benefit from collaboration with other regions to learn together how to make the best use of a wide range of biomass materials.

NCBEC and the Farm Bill

The NCBEC is honored to be asked for its input into the 2007 Farm Bill, and would like to take this opportunity to share with the Committee what it sees as three crucial priorities where

the Farm Bill could demonstrate real progress: 1) Bio-based Product Procurement; 2) Regional Feedstock Demonstrations; and 3) Local Economic Development.

The twelve state departments of agriculture in the NCBEC are part of the National Association of State Departments of Agriculture (NASDA), which is chaired in 2007 by North Dakota Agriculture Commissioner Roger Johnson, a member of the NCBEC. NASDA's Farm Bill priorities are attached (attachment 2)

1) Bio-based Product Procurement

The NCBEC will coordinate the development of a regional bio-based product procurement program for the North Central region. The US Department of Agriculture and the US Department of Energy, following authorization in the 2002 Farm Security and Rural Investment Act, has created a system under which federal agencies must purchase designated bio-based products that are available and cost-competitive with fossil-based equivalents. This provision intends to create new domestic demand for agricultural commodities, spur the industrial base through value-added agricultural processing and manufacturing, and enhance the nation's energy security by substituting domestically-produced biobased products for those made from fossil energy-based products.

The NCBEC regards the creation of a regional bio-based procurement system as "low hanging fruit" for stimulating regional bio-economy development. Creation of a regional system would dovetail with federal efforts, given that a list of products has already been designated, and the USDA has already learned many lessons from a series of rule-makings. A bio-based product procurement system for state governments would not pose an undue burden on taxpayers or administrators because of the requirement that bio-based products be available and cost-competitive with fossil-equivalent products. Finally, the region has a head-start in creating a regional bio-based product procurement program because two states have already passed legislation - ND in 2007 and IL in 2006.

Creation of a regional system has distinct advantages as well. Agreement on system design would allow any state to designate a product as "bio-based" and allow it to be adopted into the procurement system. Just as Iowa State University played a leading role in performing life cycle testing on bio-based products for the federal procurement system, any land grant university in the North Central region could test and approve products for a regional procurement system.

In this regard we would urge the Committee to reauthorize section 9002 of the 2002 Farm Bill dealing with the Federal procurement of bio-based products, and to provide the US Department of Agriculture with the resources it needs to support the development of a regional program. We would also call to the Committee's attention several other recommendations for the Energy title of the Farm Bill that have been recommended by the land grant system, through the National Association of State Universities and Land Grant Colleges (NASULGC). (attachment 1) These proposals are all designed to maintain and improve current Energy Title programs that encourage research, education, and extension efforts related to renewable energy development. A brief summary of these proposals is attached to my testimony. We would be pleased to provide the Committee with the legislative language to carry out these proposals.

2) Regional Feedstock Demonstrations

The North Central Region proposes creating collaborative feedstock demonstrations involving multiple states and partnerships between industry, producers, Land Grant Universities, State Departments of Agriculture, and federal agencies.

Background:

The next generation of the biofuels industry depends on successful deployment of a variety of new biomass feedstocks and continual improvement of existing feedstocks. Biomass materials like switchgrass and crop residues may potentially be available, but there are major hurdles exist in bringing them to market. Challenges exist at all levels including establishment, harvesting, densification, transportation, storage, handling, and pre-processing. Many companies developing biofuel processing technologies report challenges in assembling adequate feedstock for demonstration and commercial-scale projects.

At the same time, significant questions exist regarding potential sources of biomass. Can crop residues be removed without negative long-term impacts on soil quality and soil carbon? How can native grass crops best be managed to balance yields with wildlife habitat and maximize yield over the long-term? Will it be practical to manage perennial mixtures for biomass production? Is it economical to harvest forestry thinnings? What equipment improvements can bring down the cost of harvesting tree crops like poplar and willow? These are only a sampling of the questions regarding the utilization of our region's biomass resource at scale.

The only way to answer these questions is with commercial scale demonstrations for a variety of proposed biomass materials, including crop residues (corn stover, wheat straw, sugar beet pulp, rice straw), perennial crops (switchgrass, miscanthus, alfalfa), forestry residues, dedicated tree crops (hybrid poplar and willow), urban wood waste, mill residues, methane from landfills and sewage treatment, manure, and other non-perennial crops (sugar beets, sweet sorghum, grain sorghum, canola, winter canola, wheat).

The North Central Region is well-suited for large-scale regional demonstrations of feedstock. It has the capacity to produce about 90% of ethanol in existence or under construction. Our 12 states contain about 50% of the total national biomass feedstocks. The region maintains an active Land Grant research system, a strong existing biofuels industry, and political leadership in biofuels. We lead the way in demonstrating feedstock at a sufficient scale to ensure successful development of the biofuels industry's next generation.

Demonstrating biomass feedstocks at commercial scale will answer questions and solve problems that are applicable throughout the country as we set a course towards greater energy independence. We welcome the opportunity to collaborate with other regions as they seek to demonstrate appropriate feedstocks.

Principles for Regional Demonstration Projects

? Draw on existing research and demonstration projects within the region. Every state in the North Central region has research programs in bio-energy feedstocks, and many have some type of demonstration project. We propose taking advantage of existing strengths to create regional demonstration projects.

? Partner with energy producers to guarantee a market for biomass. Every state has energy projects that are proposed or in existence that could utilize cellulosic biomass, but all of them will need support in doing so. In many cases the use of cellulosic biomass will enhance the profitability and lower the risks for conventional biofuel plants. Attachments list technologies that could use biomass in a more comprehensive and detailed way (attachment 3) and specific research projects in each North Central state (attachment 4). These are a few examples of existing projects that could be leveraged:

o Indiana

? Purdue University has a variety of feedstock development and conversion research projects that are bringing advances in biofuels closer to commercialization and could provide important lessons for a demonstration project.

o Iowa/South Dakota:

? Poet Companies - based in Sioux Falls, SD, has announced that it will expand a corn ethanol plant in Emmetsburg, IA to produce cellulosic ethanol, and was recently selected as one of six cellulosic bio-refinery projects to receive federal funding.

o Iowa:

? The Chariton Valley Biomass Project in Chillicothe, IA has developed experience in co-firing switchgrass in a coal-fired power plant, but may need additional support to continue and expand this effort.

o Kansas:

? Abengoa Bioenergy, LLC, of Chesterfield, MO, like Poet, was selected to receive Department of Energy funding to build a cellulosic ethanol plant. Their plant will be located in Kansas

o Michigan:

? Michigan has a number of existing wood-burning power plants that could be utilized in demonstrating new cellulosic feedstocks to the benefit of any bio-energy project that wishes to use them.

o Minnesota:

? Three corn ethanol plants in Minnesota are experimenting with the replacement of natural gas with biomass - in the form of stillage, corn stover, and wood chips.

o Nebraska:

? USDA-ARS Lincoln has performed more than 10 years of research on native grass biomass, and has many research plots that could be leveraged to create a larger demonstration project.

o North Dakota:

? North Dakota has many biomass research initiatives at North Dakota State University and University of North Dakota - EERC. They are detailed in an attachment. The Lignite Energy Council recently completed a favorable feasibility study evaluating co-firing switchgrass and wheat straw in lignite coal-fired power plants.

o Ohio:

? Ohio State University is installing a pilot plant to convert oil and protein to electricity through

anaerobic digestion with US Department of Energy and Ohio Third Frontier funding. This technology has broad applicability for a variety of conventional and cellulosic feedstocks and agricultural wastes.

? Partner with producers to reduce their risk in experimenting with new bio-energy crops and harvesting methods. The risks involved in demonstrating experimental feedstocks cannot be borne entirely by producers. They cannot, for example, risk losing their crop histories, going without crop insurance, or bear undue risk of not selling a crop due to factors outside their control. The 2007 Farm Bill must make experimentation with bio-energy feedstock production profitable for producers if large-scale demonstrations will be possible.

? Partner with equipment producers, custom harvesters, manufacturers, and any other commercial entities that can provide services that improve cost-effectiveness and efficiency of feedstock production.

? Involve State Departments of Agriculture and Land Grant Research and Extension in projects

- o The Land Grant system can offer their expertise in a variety of ways, including creating new crop germplasm, developing new cropping systems, and development and deployment of new harvesting and collection equipment

- o Land Grant researchers can evaluate harvesting impacts on soil carbon, water quality and wildlife. They recommend best practices and evaluate project impacts on local communities.

The North Central Bio-economy Consortium welcomes the opportunity to partner with the members of this Committee, with Federal and State Agencies, with industry partners, and with partners in other regions to assure that we learn, as a nation, how to make the best use of resources for producing energy and products from plants.

3) Local Economic Development

I have spent much of my time discussing the technical, logistical, and economic challenges in developing the bio-economy, but the local impacts cannot be overlooked. Developing a bio-economy is crucially important for energy security, but it is also important because it will improve the economies of our states, bring jobs to rural areas, revive our nation's manufacturing base, and improve the lives of individuals and our communities. This is essential to the missions of all of our members - the State Departments of Agriculture, Experiment Stations, and Extension. As such, we would hope that mechanisms are in place in the 2007 Farm Bill to assure that the benefits of the developing bio-economy can accrue to local communities throughout our region. The NCBEC has identified assuring local benefits as one of our priorities, and many of our members are conducting research to evaluate the impacts of existing projects. We hope that research conducted in our region can have value to the entire nation.

Conclusion

The NCBEC would like to offer itself up as a resource to this Committee as it drafts the 2007 Farm Bill. Given our geographic and institutional representation, we are uniquely situated to offer information and guidance about the developing bio-economy in the region where it is developing the fastest. I have discussed three major priority items during my testimony today -

the creation of a regional bio-based product procurement system, the establishment of regional feedstock demonstration projects, and the importance of local economic development. We hope that these projects are only the beginning of our involvement with this Committee. Let me reiterate that although the Consortium is a regional project, we welcome the opportunity to collaborate with other regions, and hope that the lessons learned in our region are applicable around the country as our nation continues down the current path towards greater use of bio-energy to support energy independence, local economic development, and environmental protection. Thank you for your commitment to the health and vibrancy of agriculture in this country.

ATTACHMENT 1:

RECOMMENDATIONS FOR THE ENERGY TITLE OF THE 2007 FARM BILL National Association of State Universities and Land Grant Colleges

SEC. __1. PROCUREMENT OF BIOBASED PRODUCTS.

Reauthorize and amend the current law program to (1) require the Secretary of Agriculture to establish regional centers to advise and assist producers of biobased products in accessing Federal agency markets, and (2) authorize the Secretary to provide assistance develop a model State biobased product procurement law and to encourage its adoption by the States.

SEC. __2. BIOENERGY DEVELOPMENT GRANTS.

Reauthorize and expand the biorefinery development program to assist in the development of new technologies for the use of "biomaterials, and other sources of renewable energy". Require the Secretary of Agriculture to carry out a study to determine which grants made under the program resulted in successful technologies or other outcomes, and why.

SEC. __3. BIODIESEL FUEL EDUCATION AND DEVELOPMENT GRANTS.

Reauthorize the program and expand it beyond education to include assistance in the development of new technologies for biodiesel fuels production.

SEC. __4. ENERGY AUDIT AND RENEWABLE ENERGY DEVELOPMENT PROGRAM.

Reauthorize the program and require the Secretary to carry out a program to improve the energy use practices of farmers to reduce the production cost of crops and livestock, and promote the increased use of all sources of renewable energy.

SEC. __5. RENEWABLE ENERGY SYSTEMS AND ENERGY EFFICIENCY IMPROVEMENTS.

Amend the existing program to require the Secretary, directly or through one or more land grant colleges and universities, to carry out a study to determine which types of grants and loans made or guaranteed have resulted in successful outcomes, and why.

SEC. __6. BIOMASS RESEARCH AND DEVELOPMENT.

Amend the program to require the Secretary of Agriculture to work to achieve better coordination between USDA biomass research and development programs and the Department

of Energy's renewable energy programs, and to use competitively selected research centers at land grant colleges and universities to assist in carrying out the program.

SEC. __7. COOPERATIVE RESEARCH AND EXTENSION PROJECTS; CARBON CYCLE RESEARCH.

Reauthorize the extension and related carbon sequestration projects under the carbon cycle research provisions of section 221(e) of the Agricultural Risk Protection Act of 2000.

SEC. __8. ENHANCED RESEARCH ON BIOMASS AND ENERGY.

Reauthorize the Biomass Research and Development Act of 2000 and increase the discretionary authorization level from \$200 million to \$300 million annually.

Attachment 2:

National Association of State Departments of Agriculture
2007 Farm Bill Highlights

Introduction

Agriculture is an important force in the economic, social, and political fabric of America and is considered one of the protected "critical assets" of this Nation as outlined by the Department of Homeland Security (DHS). The commissioners, secretaries, and directors of the state departments of agriculture are keenly aware of the changing dynamics in food, fiber and fuel production around the world. As the chief agricultural officials in their states, they understand the importance of the entire food and agricultural sector, not only to their states but to the national economy as well. From this vantage point the National Association of State Departments of Agriculture's (NASDA) puts forward a comprehensive set of strategic policy initiatives designed to enhance U.S. agricultural competitiveness and profitability and to ensure the survivability of U.S. producers.

NASDA's purpose is to contribute to a wide-ranging and constructive debate on agricultural policy and the next farm bill. As representatives of the state departments of agriculture, NASDA members seek to outline what issues must be addressed in the next farm bill for the United States in order to allow the best avenue for protecting agriculture as a critical asset to the safety and security of this Nation and its people.

NASDA's recommendations offer a broad, opportunity-based agricultural policy focusing on expanding and improving the safety net for farmers and ranchers. NASDA's recommendations also outline bold, new ideas to address environmental and food safety challenges. For the first time, NASDA's recommendations emphasize development of renewable energy resources, nutrition initiatives, and an expanded invasive species program.

NASDA's Farm Bill recommendations encompass 209 specific recommendations in nine general policy areas. The recommendations in this paper are the highlights of NASDA's full recommendations. For the full text of NASDA's recommendations, please go to

www.nasda.org/fb2007/.

Economic Safety Net for Producers

- Maintain marketing loans and counter-cyclical payments
- Expand crop insurance options with an emphasis on whole farm revenue insurance
- Enact a permanently authorized disaster assistance program
- Payment limits must be clearly established and enforceable; the "three-entity rule" needs to be revised.
- GAO needs to study and report on the impact of direct payments on land values to provide a baseline for future policy discussions.

Access to International Markets for U.S. Agricultural Products

- Support continuation of trade promotion authority
- Continue funding for Market Access Program (MAP) and Foreign Market Development Program
- Maintain and enhance FAS Agricultural Trade Offices overseas
- Market Access for US biotech crops is important

Support for Specialty Crops

- Block grants to states, including a base grant of \$2 million to each State
- Ensure that specialty crop producers have comparable access to USDA benefits

Enhancing Environmental Quality through Partnerships with States

- Expand scope and eligibility of Conservation Security Program (CSP)
- Enact stewardship partnership agreements with States
- Enhance the Farmland Protection Program
- Improve current USDA conservation programs

Rural Development

- Enact farm/ranch profitability grants
- USDA-Rural Development programs need to be available for rural areas in proximity to metropolitan areas

Providing Safe, Healthy, and Nutritious Food

- Expand the DoD Fresh and USDA Fruit and Vegetable pilot programs to all states
- Improve funding and delivery of nutrition programs
- Allow interstate sales of state-inspected meat and poultry
- Enact pre-harvest food quality assurance partnerships with States

Support for Bio-industry Development with Emphasis on Energy Production

- Implement the 25x25 agriculture energy initiative with emphasis on the development of alternative fuels from agriculture commodities and other biomass
- Make permanent the tax credits for ethanol and biodiesel
- Establish on-farm incentives to produce and utilize solar, wind, and biobased energy, including allowing use of CRP land for production of energy and biobased crops with commensurate payment reductions
- Develop a cellulosic/energy feedstock production base enrollment program using long term

contracts

Identification and Removal of Invasive Species

- Enhance non-native pest and disease identification and eradication/control programs consistent with safeguarding principles, e.g. expand prevention and early detection and rapid response programs
- Expand funding sources through a streamlined, dedicated appropriation with block grants to states to expand programs
- Continue emphasis on sound-science and SPS harmonization in trade agreements
- Improve inspection of cargo arrivals

All-Hazards Security Programs

- Expand state emergency programs for food and agriculture consistent with federal emergency preparedness and response programs
- Enhance animal identification programs to assure state and federal animal health objectives are met

Research and Information

- Ensure data collection needs are met
- Increase funding in research, extension, and education programs

Biotechnology

- Create a federal office to assure communications, cooperation and coordination of information between federal and state agencies

Other Critical Issues - Labor and Transportation

- Availability of agricultural labor force through guest worker program
- Rivers, Rails and Roadways: Critical investments needed to maintain agriculture's competitiveness in world marketplace

Role of States

- State departments of agriculture should be full partners with USDA in program delivery to producers through partnership agreements, block grants, and pilot projects

Attachment 3:

Bio-energy Projects in the North Central region by technology

There are a variety of projects in the North Central region that already use cellulosic biomass, plan to do so, or could if they so choose. This is not an exhaustive list, but merely provides some examples of projects that could demonstrate biomass feedstocks at commercial scale:

Pyrolysis and Gasification

Pyrolysis applies heat and pressure to biomass in the absence of oxygen for a brief duration to produce liquid "bio-oil", char, and gases. Bio-oil is a mixture of hundreds of compounds that distilled into multiple high-value chemicals and fuels. The charcoal produced from pyrolysis can be used as a soil amendment. As one example of a high-value chemical product from bio-oil, the Red Arrow company in Wisconsin produces Liquid Smoke food flavoring. This

process is currently commercial.

Gasification is similar to pyrolysis but by using higher temperatures and longer duration it breaks down biomass completely to hydrogen and carbon monoxide. This "producer gas" can be combusted or, using various processes, transformed into pipeline-quality natural gas, various liquid fuels such as alcohols and Fischer Tropsch Diesel, and other chemicals. There are numerous gasification projects at various scales around the region. Gasification is currently commercial for many applications; while other applications are still under development.

Anaerobic Digestion

Many places around the region demonstrate anaerobic digestion of manure, distiller dry grains, oils, proteins, and other materials into bio-gas and other products. This process, when used with manure, frequently involves the addition of some cellulosic biomass as part of the feedstock. It is usually partly a waste-disposal strategy in addition to an energy production strategy.

An example is a pilot plant for oil and protein conversion to electricity that Ohio State University is installing this summer with US Department of Energy and Ohio Third Frontier funding. The economically-driven program initiative involves conversion of animal and food processing waste into clean, renewable energy (electricity) via biodigesters that turn the waste into biogas and fuel cells that turn biogas (also direct feedstocks such as soybean oil) into energy. This technology is important to rural communities and on-farm production of energy and fits the overall theme of NC-BEC (it also fits Ohio particularly well as we have an 11 million population but an \$80B ag sector of which food processors comprise \$30B; the technology should be adaptable to other states and their specific opportunities).

Process heat:

Gasification or combustion of biomass to provide process heat is a commercial process. One ethanol plant, Central Minnesota Ethanol Company in Little Falls, MN, already operates a gasifier in this way primarily using wood waste. This facility, and other ethanol facilities, could use perennial bioenergy crops as well, but this concept needs to be demonstrated.

Any other commercial or industrial facility with a process heat requirement could use bioenergy crops in the same way. The potential market for heat biomass is enormous in the North Central region.

Some ethanol plants with fluidized coal bed boilers may be able to use bioenergy crop in combination with, or to replace coal for process heat. This is a near-term application for biomass.

Pellet Stoves:

There are several companies around the North Central region that produce biomass pellets for use in home heating. This is a commercial application with a large market. It is possible to make biomass pellets from any type of biomass, including switchgrass, poplar and willow. There are currently pelletization projects in Minnesota, Missouri, Wisconsin, and other states.

Coal-fired power plants:

Virtually any coal-fired power plant could co-fire biomass with coal to produce electricity. The Chariton Valley Biomass Project in Chillicothe, Iowa demonstrated this concept. Additionally, Alliant Energy's 800 MW Ottumwa Generation Station has co-fired up to 2% switchgrass. Alliant believes its Nelson Dewey plant in Cassville, WI could also use switchgrass, wood or corn stover in addition to coal and petroleum coke. Alliant has filed petitions with the Public Service Commission about this usage of the Nelson Dewey Plant and depending upon approval, could be operational by 2012-2015. This facility could scale-up this concept and in fact tried to do so at countless other pulverized coal plants around the North Central region.

Direct Combustion:

Many states have facilities that currently burn biomass to produce heat and electricity. These projects are primarily in states with existing wood products industries.

? Michigan currently burns wood chips and forest waste products in six commercial facilities to co-generate electricity. They have a combined capacity of 368,170 kW per year.

? Wisconsin and Minnesota also have several facilities burning wood and wood waste for energy.

Cellulosic ethanol:

On February 28, 2007 Department of Energy (DOE) Secretary Samuel W. Bodman announced that DOE will fund six biorefinery projects over the next four years with up to \$385 million in federal funds. The biorefineries are expected to produce more than 130 million gallons of cellulosic ethanol annually as well as biobased products, including: power, methanol, hydrogen, and ammonia. Each biorefinery will use more than 700 tons of feedstocks per day including agriculture residues such as corn stover, wheat and rice straw; wood residues, wood-based energy crops; landfill organic wastes; and switchgrass. Two of these facilities will be located in the North Central region (see below).

Not listed below is another project approved for a DOE grant. A technology to convert forest thinnings/woodchips to ethanol currently exists based on research conducted in Fayetteville, Arkansas by Bioengineering Resources, Inc. Commercial development is also underway in LaBelle, Florida by Alico, Inc. This technology could utilize another feedstock common in the North Central region.

Abengoa Bioenergy, LLC of Chesterfield, Missouri, up to \$76 million.

The proposed plant, located in the state of Kansas, will produce 11.4 million gallons of ethanol annually and enough energy to power the facility, with any excess energy used to power the adjacent corn dry grind mill. The plant will use 700 tons per day of corn stover, wheat straw, milo stubble, switchgrass, and other feedstocks.

POET (formerly Broin) Companies of Sioux Falls, South Dakota, up to \$80 million.

After expansion, the plant, located in Emmetsburg, Iowa, will produce 125 million gallons of ethanol per year, of which roughly 25 percent will be cellulosic ethanol. For feedstock in the production of cellulosic ethanol, the plant expects to use 842 tons per day of corn fiber, cobs, and stalks.

Co-gasification with coal:

Analysis by Bob Williams at Princeton University suggests that by co-gasifying coal and biomass, capturing and storing carbon dioxide, and producing electricity, liquid fuels and other products, that net carbon neutral or even carbon negative energy would be possible. The carbon produced and stored in the plant through photosynthesis is not re-emitted to the atmosphere through combustion, but captured in the gasification process. Perennial crops would be particularly advantageous because they sequester additional carbon in the soil.

At least one European gasification plant - a 250 MW facility operated by the Dutch utility Nuon in Buggenum, Netherlands - co-gasifies up to 30% biomass with coal to produce electric power. This technology, known as integrated gasification-combined cycle (IGCC), is fully commercial in Europe, and the Buggenum plant demonstrates the technical ability to co-gasify biomass at scale. Nuon is now planning biomass co-gasification with coal for diesel fuel production for a much larger 1,200 MW plant to be operational by 2012. The plant will have a 750 MW IGCC component.

There are IGCC and coal-to-liquid gasification plants under development in the North Central states of Illinois, Indiana, Minnesota, and North Dakota. Although all of them could co-gasify some amount of biomass, none of the plants have firm plans to do so at this time. However, the Great River Energy-Headwaters, Inc. project team recently visited the Buggenum plant and met with gasifier vendors with biomass gasification experience. The team is developing a lignite gasification plant with carbon capture that will produce both electricity and liquid fuel plants in North Dakota. Follow-up discussions have occurred about the possibility of co-gasifying switchgrass, grass mixtures, or wheat straw with lignite.

Given that there will be commercial scale IGCC and coal-to-liquids facilities in the North Central region within five years, co-gasification of perennial bioenergy crops could be possible within that timeframe as well, assuming the availability of incentives to support demonstration of a biomass stream in one of the early commercial plants.

NDSU/MBI Biomaterials Initiative

Many research efforts are underway throughout the region to develop bio-based products - many of which could be produced from native perennial feedstocks.

The North Dakota State University/MBI team, with initial funding from USDA-CSREES, is working to develop and commercialize a bio-based nanocomposite material that could substitute for fiberglass and petroleum-based composites. Wheat straw will be the initial feedstock, although other local raw materials such as switchgrass and industrial hemp could qualify. This technology will be integrated as part of a multi-product biorefinery, which will produce ethanol and electricity as well as cellulose nanofibers for the nanocomposite material. The preliminary investigation phase of this project is complete with promising results.

Attachment 4:

Biomass Feedstock Research in the North Central region by state

Illinois:

- ? A research program on miscanthus at the University of Illinois - Urbana-Champaign led by Dr. Stephen Long
- ? Research on Molecular Bioengineering of Biomass Conversion being done with the Institute for Genomic Biology, for which Dr. Blaschek serves as theme leader.

Indiana:

At Purdue:

- ? DOE-funded research on poplar;
- ? NSF funded project on cell wall biosynthesis in grasses;
- ? Improved biomass production in switchgrass.
- ? These projects should result in outcomes that would bring them closer to commercial production in about 5 years.

Iowa:

- ? Research on switchgrass at Iowa State University, partly in support of Chariton Valley Biomass Project.

Kansas:

- ? Kansas Wheat is very aggressively pursuing research and demonstration of wheat straw as an ethanol feedstock, and that they have talked with Abengoa Energy, which has received a DOE grant to build a cellulosic ethanol plant (one of six grants announced at the end of February) here in Kansas. They have talked to many growers and are seriously working on issues of supply, storage and transportation.
- ? Kansas State University is investigating the production of ethanol from grain sorghum and millets, as well as cellulosic production from various types of straw and stover.
- ? Research is being done on the integrated systems involving prairie and grazing lands, our cattle feeding industry and our current ethanol production
- ? A green energy facility is under consideration for development in conjunction with a proposed new coal generation facility located at Holcomb, KS

Michigan:

The Michigan State University Office of Biobased Technologies (OBT) has several research

projects on bioenergy feedstocks and conversion, including:

- ? Research to allow corn to produce its own cellulose enzymes,
- ? Research on ammonia fiber expansion to pre-treat biomass for conversion to biofuels
- ? Basic genetic research
- ? A research plot on various biofuel crops, including switchgrass

Minnesota:

- ? Conducted research showing that mixed prairie grasses on marginal land significantly increase biomass yields (as compared to monocultures such as switchgrass) and may be a significant source of biomass for "carbon-negative" biofuels.
- ? Studied the use of alfalfa, willow and other woody perennials as energy sources; developed and tested new hybrids of poplar to increase their genetic diversity, disease resistance, and yield, especially on marginal soils; studied land management practices that increase biomass yields while improving soil and water productivity, reducing runoff and erosion, protecting water quality, conserving fish and wildlife habitat, and sequestering carbon.
- ? Developed methods for densifying and pre-treating bulky biomass crops to facilitate their storage and transportation (liquefaction and microwave pyrolysis to produce liquid bio-oils, and syngas; pelletization of switchgrass and corn stover).
- ? Conducted tests of the gasification of corn stover and distillers grain for a Biomass Gasification System on the University of Minnesota Morris campus.
- ? Engineered bacteria that create fuel hydrocarbons in hours versus the millions of years required for fossil fuels.
- ? Developed novel autothermal reforming technologies to produce hydrogen from ethanol and other forms of renewable biomass.
- ? Expanded the focus of the Center for Diesel Research to include development of a biofuels and bioproducts research facility at the University of Minnesota; developed fuel delivery and nozzle-atomization systems and modifications that improve the performance of ethanol and other biofuels in engines.
- ? Developed a scalable biorefining model for processing corn and other forms of biomass into ethanol and a variety of intermediate products (biodiesel, biopolyols, oil).
- ? Converted livestock waste to energy, fuels, and bio-based products.
- ? Developed a novel process for degrading the lignin in woody biomass with enzymes.
- ? Begun developing a metagenomics approach to isolate novel enzymes that have the ability to convert cellulosic biomass into sugars .
- ? Studied the economic and environmental impacts of biomass-fueled versus coal-powered ethanol plants.
- ? Research on bio-based products such as polyurethane foam, polyester, and biodegradable plastics.

Missouri:

- ? Forest management plans are being developed for public lands around the state - including the Mark Twain National Forest - for harvesting small diameter trees and trimmings.
- ? The potential energy output from forestry in Missouri is outlined in a draft study from the Agroforestry Center at the University of Missouri titled "Utilization of Missouri Ozark Small-

diameter Trees and Their Waste Wood Residuals."

Nebraska:

? USDA-ARS, Grain Forage and Bioenergy Research Unit - Research on switchgrass, prairie grasses, and prairie legumes - focused on developing switchgrass and other perennial species as feedstocks for biofuels since 1990. ARS-Lincoln conducted a 5 year on-farm study in 10 farm location in NE, SD and ND and data shows that switchgrass can be grown, hayed and renewably harvested as a bioenergy feedstock over a five-year period - this study also demonstrated that producers can optimally manage switchgrass in monoculture to provide feedstock in a cost-efficient and environmentally sustainable manner. Other work is ongoing on developing sorghum and wheat suitable for the bioenergy sector

North Dakota:

? The NDSU/MBI Biomaterials Initiative is investigating the use of wheat straw and other cellulose materials to produce biobased composites that could substitute for fiberglass and petroleum-based composites. Although wheat straw is the initial focus, this process could utilize switchgrass and other biomass materials.

? USDA-ARS North Great Plains Research Project: Establishing 18 research/demonstration plats at 6 locations in North Dakota with perennial herbaceous crops to collect baseline soil quality data, evaluate different perennial crops, and evaluate harvest impacts, economics, soil carbon storage potential, and the impact of alfalfa on stand yield and maintenance.

? EERC Center for Biomass Utilization: The Energy and Environmental Research Center at University of North Dakota conducts research on biomass utilization. Currently nearly \$5 million of activities are funding in CBU through industry investment; local, state and federal government contracts; and industry-government joint ventures.

? NDSU Agricultural Experiment Station: A dedicated bioenergy crop study initiated by many government, research, NGO, and industry partners in the state.

Ohio:

? Census of feedstocks and feedstock opportunities assembled to provide framework for policymakers.

? Assessment of feedstock alternatives, especially in relation to carbon management/maintenance.

? Bioconversion technology (waste to energy).

? By-product utilization and product development.

South Dakota:

At South Dakota State University:

? Switchgrass breeding program,

? Research on grass based mixtures

? Impacts on soils, water and wildlife

Wisconsin:

? Agrecol Corporation of Madison and Evansville have been growing switchgrass for several years and already use a pelletization process to heat their commercial buildings. They are

launching an expanded research project for switchgrass to energy use.

? Alliant Energy is already doing research for their proposed Nelson Dewey facility.

? Also, see above projects listed under working on commercialization.