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GRANT APPLICATION TRANSMITTAL

This page indicates university endorsement of the referenced proposal and is intended to be submitted to the sponsor organization.

Sponsor Organization:	North Dakota Industrial Commission
Project Title:	*Biomass Processing, A Mobile Demonstration and Education Program*
Project Director:	Cole Gustafson
Department:	Agribusiness and Applied Economics
Project Budget:	$580,710
Authorized University Representative:	Amy Scott
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Date:	4-28-09

Any future notifications regarding this proposal, including award notices, should be directed to the authorized university representative at the address listed above.
Thank you.

Title Page

Project Title: Biomass Processing, A Mobile Demonstration and Education Program

Applicant: Dr. Cole Gustafson
Dept. of Agribusiness and Applied Economics
North Dakota State University

Principal Investigator: Dr. Cole Gustafson

Date of Application: April 30, 2009

Amount Requested: $580,150

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Abstract

The federal government is placing greater attention on carbon emissions which is expected to result in rising demand for biomass renewable energy feedstocks, especially among coal-fired heating plants in the Northern Plains. North Dakota has been identified as a potential leading supplier of biomass renewable energy feedstock. Numerous counties have the potential to supply over 500,000 tons annually. Cropland and range research trials are being conducted at numerous NDSU Research Extension Centers (NDSU-RECs) and the USDA ARS Northern Great Plains Research Laboratory (USDA ARS) in Mandan to develop production guidelines in advance of farmer and rancher demand.

Great River Energy (GRE) is also proactively preparing for increased carbon regulation with development of a combined heat and power facility near Spiritwood, ND. The project proposes to develop a biomass supply infrastructure for co-firing up to 10% biomass at the Spiritwood Station. In addition, there is significant potential for supplying 100% biomass to a cellulosic ethanol or value added industrial biochemical plant that may elect to co-locate at the Spiritwood Industrial Park. To move forward, GRE is in the process of completing a Biomass Co-firing Feasibility Assessment to determine whether or not a sustainable biomass business model can be developed in the area of Spiritwood, North Dakota (NDIC Contract R001-003).

A key void identified in that study are several knowledge gaps among farmers and ranchers who would potentially supply biomass to the facility. Producers were not aware of biomass market opportunities, preferred biomass harvest timing, product qualities, or methods to reduce environmental impact. While future demand for renewable energy feedstocks is well documented and considerable research is underway evaluating the agronomic aspects of producing biomass in research field trials, scant information exists on either the quality of alternative biomass feedstocks, operational and logistical methods of biomass processing, and alternative supply chain arrangements.

This two year, $580,710 project proposes to: 1) Develop an educational program and construct a mobile biomass processing unit, and 2) Establish a biomass testing lab. The demonstration unit would illustrate biomass engineering technology, process flows, feedstock quality requirements, alternative market premium and discount quality factors, carbon balances, and optimal environmental management. Each level of the biomass industry (e.g. collecting, processing, and marketing agricultural biomass feedstocks for renewable energy production) would be addressed. The lab would evaluate physical and thermal characteristics of diverse feedstocks and denisfied biomass. Feedstocks from on-site research plots, RECs, and agricultural suppliers will be used for biomass performance testing. The primary target audience is potential agricultural feedstock suppliers but results will have a positive impact for processing equipment developers and merchants. Such work will also demonstrate to the national biomass processing industry that North Dakota has the resources and expertise to grow and deliver high-quality biomass feedstocks for use in electricity or liquid fuel production.

The project will be lead by North Dakota State University in collaboration with USDA-ARS Mandan, North Dakota Farmers Union, Great River Energy, Federal Machine, and Ulteig.

Project Description

Objectives

1) Develop an educational program and construct a mobile biomass processing demonstration unit. The demonstration unit would illustrate biomass engineering technology, process flows, feedstock quality requirements, alternative market premium and discount quality factors, carbon balances, and optimal environmental management. Each level of the biomass industry (e.g. collecting, processing, and marketing agricultural biomass feedstocks for renewable energy production) would be addressed.

2) Establish a biomass testing laboratory to evaluate physical and thermal characteristics of diverse feedstocks and denisfied biomass. Feedstocks from on-site research plots, RECs, and agricultural suppliers will be used for biomass performance testing

The primary target audience is potential agricultural feedstock suppliers but results will have a positive impact for processing equipment developers and merchants. Such work will also demonstrate to the national biomass processing industry that North Dakota has the resources and expertise to grow and deliver high-quality biomass feedstocks for use in electricity or liquid fuel production. Additional effects will be seen by investors, community developers, environmentalists, students, and the general public.

Background and Need

On April 17, the Environmental Protection Agency (EPA, 2009) announced that carbon dioxide (CO_2) and five other industrial emissions endanger "the health and welfare of current and future generations" and are "the first formal recognition by the U.S. government of the threats posed by climate change," according to Lisa Jackson, EPA administrator. Following this action, it is widely expected that the Obama administration will proceed to implement a cap and trade system to regulate carbon. In testimony to the House Energy Committee on April 22, 2009, Ms. Jackson stated energy power plants and the automobile industry are initial primary targets for regulation.

North Dakota is one of the nation's primary suppliers of coal. Consequently, electrical utilities, state heating plants, and industrial processing plants throughout the region rely heavily on this energy resource. Firms impacted by this policy change range from Great River Energy (GRE) to North Dakota State University (NDSU) and American Crystal Sugar. Imposition of a cap and trade regulatory scheme would cause these firms to either invest significant new resources in clean energy technology or purchase renewable energy feedstocks and/or carbon credits to mitigate regulatory effects. Either choice is expected to increase operation costs and place these firms at a competitive disadvantage.

Fortunately, North Dakota has also been identified as a potential leading supplier of biomass renewable energy feedstock (U.S. Dept of Energy, 2009). Numerous counties have the potential to supply over 500,000 tons annually. Cropland and range research trials are being conducted at numerous NDSU Research Extension Centers (NDSU-RECs) and the USDA ARS research facility in Mandan. The Bio Energy and Product Innovation Center (BioEPIC, 2009) was

created to serve as a single site at NDSU to develop, coordinate, and promote development of renewable energy activities at NDSU. Several conferences and educational programs have been conducted to inform state citizens and firms of these research activities and results.

National interest in North Dakota feedstock supply availability is especially keen given the perception that large portions of the state's land are of marginal quality. Collection of biomass from these lands is perceived to have less impact on food production for human consumption. However, these same individuals fail to realize the additional care required to minimize environmental damage to these fragile lands, native plants, and wildlife. Biomass education programs are needed to inform the public on the scientific merits of each view.

GRE is proactively preparing for increased carbon regulation with development of a combined heat and power facility near Spiritwood, ND. The project proposes to develop a biomass supply infrastructure for co-firing up to 10% biomass at the Spiritwood Station. In addition, there is significant potential for supplying 100% biomass to a cellulosic ethanol or value added industrial biochemical plant that may elect to co-locate at the Spiritwood Industrial Park

To move forward, GRE is in the process of completing a Biomass Co-firing Feasibility Assessment to determine whether or not a sustainable biomass business model can be developed in the area of Spiritwood, North Dakota (NDIC Contract R001-003). As a potential purchaser of biomass fuel, GRE finds itself in a classic chicken and egg situation. Industry is reluctant to invest in a biomass processing plant without the existence of a reliable feedstock supply. Likewise no biomass supply chain exists because the market for such a product has not yet been established.

The GRE study aims to evaluate the specific types of biomass that may readily exist or be established in the future, along with combustion characteristics, and expected delivered costs. From a prospective producer standpoint, the study illustrates a process schematic for the biomass harvest and delivery business model along with tools to help evaluate the economic costs and benefits for entering this market.

Preliminary results find great biomass supply potential within a 100 mile radius of Spiritwood as shown in Table 2 of their report:

Table 2. Waste Resources Within 100-mile Radius of Spiritwood, North Dakota

Waste Resource	tons/yr
Corn Stover	1,200,000
Wheat Straw	690,000
Hay	550,000
Corncobs	400,000
MSW	330,000
Sugar Beet Foliage	100,000
Barley Waste	54,000
Potato Waste	44,000
Municipal Wood Waste	14,000
Sunflower Hulls	8,800
Sugar Beet Pulp	5,500
Total	3,400,000

Upon further analysis, the top five feedstock potentials highlighted in the GRE report are:

Table 5. Revised Costs and Comparison for Top 5

(per ton)	Harvesting	Commodity	Transportation	Total
Corncobs	$31	–	$14	$45
Grasses*	$23	$8	$14	$45
Corn Stover	$16	$16	$14	$46
Sugar Beet Foliage	$16	$8	$14	$38
Wheat Straw	$16	$16	$14	$46

* CRP grasses, switchgrass.

Another dimension of the GRE study was to determine producer interest in supplying biomass and preferred participation in alternative supply chain network designs. Three focus groups were conducted March 2-3 in Carrington, Jamestown, and Streeter. A total of 21 producers participated in these sessions.

A striking observation from these groups was that most producers were not aware of the Spiritwood project and its commitment to use biomass. Moreover, several additional knowledge gaps became apparent when a fourth focus group was convened with 9 producers. The purpose of this group was to evaluate a spreadsheet decision tool designed to assist farmers and ranchers in comparing net returns from a biomass activity with existing production enterprises. To motivate producer interest, Steve Flick, manager of Show Me Energy, Missouri, participated and presented a detailed overview of their biomass purchasing and processing operation.

Producers were not aware of preferred biomass harvest timing, product qualities or methods to reduce environmental impact. Attendees had expected biomass harvest to conflict with either summer or fall machinery operations. Mr. Flick stated the ideal biomass harvest time is late winter before spring field operations begin. He also noted that preferred moisture was as low as possible. He indicated that biomass is purchased solely on the basis of BTU content, moisture and weight. One third of potential biomass is left unharvested to preserve environmental quality and soil health. While most biomass is sold in bulk to wholesale buyers (e.g. electric utilities), one fourth is bagged and sold retail at $150/ton. Show Me Energy pellets produce electricity at a

cost of $0.03/kwh. Finally, producers were unaware of potential processing byproducts. Residual ash is high in potash and an excellent fertilizer with a cost of $2/ton. Having just experienced record high fertilizer prices, this caught the farmer's attention.

Mr. Flick proceeded to describe the two most important challenges facing the plant – silica and embedded metal which are highly corrosive and destructive to processing machinery. All feedstock is first ground in a specialized grinder and then pelleted to ¼" size. Considerable discussion ensued with respect to preferred feedstock qualities, processing requirements, and producer's ability to meet those standards.

The ND Industrial Commission has also provided funding to Federal Machine to develop the next generation of biomass densification technology. Although not commercially available, the addition of a prototype machine to the demonstration unit would showcase project progress and provide important user feedback. The performance and merits of the prototype machine relative to traditional pelleting equipment is unknown, leading to another knowledge gap.

In summary, a substantial void exists in the producer's knowledge of biomass processing. While future demand for renewable energy feedstocks is well documented and considerable research is underway evaluating the agronomic aspects of producing biomass in research field trials, scant information exists on either the quality of alternative biomass feedstocks, operational and logistical methods of biomass processing, and alternative supply chain arrangements.

Methodology

To inform North Dakota producers and others about the process of converting biomass feedstock to renewable energy, a two-part education program is proposed. The first aspect centers on construction of a mobile biomass processing demonstration unit and the second is equipping a lab to evaluate quality of alternative biomass feedstocks. Such a laboratory would support both research and educational efforts described in Objective 1.

1) Mobile Demonstration Education Program

The plethora of farm trade shows, public/private research field days, and NDSU Extension Service document the importance of "hands-on" and peer-to-peer learning in the agricultural sector. Therefore, this project proposes to construct a mobile demonstration-scale biomass processing display. The unit will be featured at NDSU-REC and Mandan ARS annual field days, newly created events targeting the Spiritwood project, and other renewable energy forums and farm trade shows across the region. A two-year timeline is proposed:

May-Oct. 2009

A basic biomass processing demonstration display and supporting educational program will be developed and delivered to events noted above. The basic display will consist of an 80hp tractor/loader, grinder and pellet mill. The grinder and mill will be mounted on a trailer and pulled by truck to each event. The tractor loader will handle biomass and pellets produced. The grinder and mill will be hand-fed. Hay will be the predominant feedstock initially. While not

automated, the display will serve to introduce the topic and capture the audience's attention, providing an immediate educational forum. If the Federal Machine prototype is not available, a diagram illustrating the process will be included. A research associate under supervision of the principle investigator will develop the curriculum, with special attention devoted to the educational voids identified earlier.

Oct. 2009-April 2010

The display will be upgraded and refurbished as part of a design course for senior agricultural engineering students at NDSU. Students in the class will design and fabricate material handling and monitoring equipment to automate the process as well as measure the quality of incoming biomass feedstock and pellets produced. The forum of a class project is chosen to build student awareness and educate them about renewable energy and biomass processing opportunities. Conversations with parents and friends are expected to leverage the educational program. A graduate student will evaluate the economic potential of diverse biomass feedstocks, premiums/discounts, and contract terms that were not formulated as part of GRE's research due to lack of producer awareness.

May 2010-May 2011

The upgraded biomass processing display and revised educational program will again be showcased in the venues listed above. Enhanced handling capabilities will enable a wider variety of biomass feedstock forms to be utilized (round bales, small squares, etc.) Moreover, producers will be offered the chance to submit more diverse feedstock supplies (crop residues, native grasses, etc.). Federal Machine is expected to have their torrefaction process machine available at this time and will be included.

2) Biomass Processing Lab

A new biomass processing lab will be instrumented to test and evaluate the quality of diverse biomass feedstocks in both raw and pelleted forms. Feedstocks will be evaluated for potential in renewable energy production and/or carbon credit generation. The laboratory will be able to analyze perennial grass and other feedstocks for combustion properties and suitability for biomass densification. Four pieces of specialized equipment are requested - TGA analyzer for thermal analysis, MTI universal testing machine for strength testing, an environmental control chamber for pellet storage and hydration studies, and a bomb calorimeter for quantification of feedstock energy content. These items will complement other equipment that the Northern Great Plains Research Laboratory (USDA/ARS) is committing to the project. A new NDSU faculty member in Agricultural and Biosystems Engineering is in the process of being hired and will be stationed at the USDA/ARS facility in Mandan.

The central location of this testing facility will provide ready access to all state residents and researchers. The site also offers ample acreage for biomass production studies and the new faculty member is expected to collaborate with other NDSU and ARS employees already working there on various biomass production trials. This growing network of scientists and engineers includes: 1) agronomists working on biomass production and ecological modeling, 2)

engineers working on biomass harvest, densification, and storage, and 3) end users such as GRE testing biomass co-firing and other NDSU researchers in Fargo using materials for fermentation to ethanol. This collaboration will help integrate findings across the biomass supply chain to show producers and processors which crops will be most desirable in North Dakota. While other sites in the state are capable of performing these tests, they do not have the capacity to handle the increasing volume of biomass expected. The bulky nature of the product also precludes shipment over great distance.

Results

It is anticipated that the mobile demonstration unit will engage attendees of the educational program, heighten their interest in renewable energy, inform them of emerging opportunities to supply biomass feedstock and increase their awareness of both environmental opportunities and obligations. The tangible nature of the display and process will likely stimulate several attendees to organize, either individually or collectively, and invest in supply networks to provide biomass at either wholesale or retail levels.

Facilities and Resources

Sufficient facilities and resources are available to ensure a successful project. The presence of NDSU Extension across the state, wealth of faculty research expertise, and contacts with agricultural leaders, energy firms, and environmental groups assure development and delivery of high quality educational materials targeted to the specific interests of potential attendees.

Environment and Economic Impacts

The goal of this project is to discern process design/organization, environmental, and economic impacts of a proposed biomass processing facility in the state. Improved knowledge among producers will improve the likelihood that sustainable environmental practices will be followed as the biomass industry develops.

The economic impact of biomass processing for the state has not been quantified, but is expected to be significant. Assume that 2/3 of the 3.5 million tons of biomass available in the 100 mile area surrounding Spiritwood are fully utilized for biomass (e.g. 1/3 is left undisturbed for environmental reasons). With a revenue margin potential of $110/t ($150 retail pellet price less $40 payment to producers), biomass processing has the opportunity to provide an additional $385 million of economic expenditures to the area. In addition, farm profitability is enhanced and diversified, and local communities benefit from secondary economic impacts. When cap and trade schemes for carbon are implemented at the national level, perennial biomass renewable energy credits will increase in value.

Finally, more informed producers (especially with respect to biomass quality attributes), preferred processing technologies and flows, and economic premiums and discounts, will elevate business climate potential while minimizing investment risk in substandard technology or supplier organizations.

Standards of Success

Given that North Dakota has potential to be a leading biomass-producing state, it is imperative that NDSU be actively involved in supporting the emerging renewable energy industry by providing credible scientific research and supporting outreach educational programs that enhance the industries' development, productivity, and profitability. North Dakota does not have a commodity group advocating the interests of biomass producers. NDSU does have a critical mass of faculty with special expertise in biomass field and grazing trials, as well as other production research. However, NDSU does not have the resources to implement a new biomass processing program alone. For NDSU to achieve our objectives, we must collaborate both internally as well as with private businesses as proposed in this study.

The partnerships described here are essential to broaden and enhance the biomass opportunities being made available to North Dakota producers, both locally and nationally. Existing biomass research trials will provide producers with new production information. New federal carbon legislation creates an unprecedented demand for biomass and renewable energy products. Currently, the most immediate constraint to development is a knowledge void among producers regarding biomass process opportunities and operations. This project strategically positions North Dakota to participate in the rapidly changing biomass, renewable energy, and carbon industries. The vision of project partners in this study is such that they could change the economy of North Dakota. The environmental and economic aspects of this opportunity are summarized in the prior section.

Development of an educational program is the central focus of this project. As an academic institution, NDSU has detailed criteria and processes in place to evaluate the achievements of an educational program. The process begins with identification of the audience, formulation of learning objectives, monitoring student accomplishment at varying stages of program development, and then measuring behavioral changes following conclusion of the effort. All of these steps will be conducted and reported in the interim and final reports discussed below.

Background and Qualifications

The summary of prior work (e.g. GRE study) related to the project is reviewed in the Project Description above. University of North Dakota's Energy and Environmental Resource Center (EERC) and Minnesota's Agricultural Utilization Research Institute (AURI) have investigated the performance of alternative processing and densification technologies. While EERC hosts an annual biomass conference and AURI conducts period tours of their facilities, their research results are not readily available to interested producers. Moreover, their studies do not address the technical difficulties and broader economic and environmental questions likely encountered at the farm or ranch level. Dr. Gustafson has just received $100,000 from a nationally competitive SUNGRANT to investigate harvest timing of corn stovers in the northern plains for biomass processing. Although related to this project, that effort will focus on farm activity scheduling and does not investigate biomass processing.

Dr. Gustafson serves as principal investigator of the project. He is currently co-director of BioEPIC which provides him ready access to all NDSU bio-product researchers. In addition, he is keenly aware of the project need having received the sub-contract for Step 5 of GRE's biomass assessment study. Dr. Gustafson has an international reputation in biomass research with a bi-weekly news column and more than 60 professional and lay presentations being delivered in 10 states during the past year.

Management

Dr. Gustafson will oversee all aspects of the project. A four-member reaction panel will be formed to guide the project and consist of a farmer and one representative from GRE, USDA-ARS Mandan, and NDSU-REC. The panel will offer input on design of the mobile display and the biomass lab. In addition, they will be asked to review and critique educational materials that are developed as part of the project. Interim reports provided on the schedule outlined in the next section will assure the project remains on tract. An audience response system (Turningpoint) will be utilized to obtain anonymous evaluation results from attendees who view the display. These results will be summarized periodically throughout the project with suggested changes incorporated mid-stream. A final report will contain all evaluation results and program adjustments made.

Timetable

The project will commence June 1, 2009 and end two years later on May 31, 2011. The three phases of the project were described in the methodology section. Interim and final reports summarizing program accomplishments will be provided following completion of each phase – Oct. 31, 2009, April 30, 2010, and May 31, 2011.

Budget

Capital Costs, Mobile Demonstration	
80 hp tractor and loader	$55,000
Grinder	20,000
Pellet mill	17,000
Trailer	15,000
Diesel powerplant	4,000
Instrumentation	5,000
Bale feeder	3,000
Conveyors and bins	2,000
Misc. steel and fabrication	1,500
Bale spear	1,000
Subtotal	$123,500
Capital Costs, Biomass Lab	
TGA analyzer	$90,000
MTI universal testing machine	80,000

ENV control chamber		65,000
Bomb calorimeter		50,000
	Subtotal	$285,000

Operating Costs	
Truck (5,000 miles @ $0.65/mile)	$3,250
Research Associate (2 years @ $52,000/year)	104,000
Graduate Student (2 years @ $14,000/year)	28,000
Fringe Benefits (35% Res. Assoc., 2% grad. student	36,960
Subtotal	$172,210
Total Project Cost	**$580,710**

Justification

All of the above costs will be supported by the grant. Funding is required to meet project objectives because sufficient internal resources are not available and external entities view general biomass education as a responsibility of the public sector. If funding fails to materialize project objectives will be delayed. Objectives 1 and 2 are both scalable and modular so progress can proceed with reduced funding. The following external match fundings have been arranged to complement program objectives:

USDA-ARS (in-kind equipment)	$127,200
North Dakota Farmers Union	1,000
Subtotal	$128,200

The USDA-ARS match represents an in-kind contribution of remaining equipment needed for the biomass lab to become operational whereas the NDFU monies will help defray costs of purchasing biomass and other supplies needed for demonstration.

The 80hp loader tractor is needed to move biomass to the mobile display and remove pellets after processing. Both a bucket and bale spear will be purchased. A tractor of this size is needed to safely move large and densely packed biomass bales. During year one, the tractor will also power both the grinder and pellet mill. When the display is refined in year two, a separate diesel powerplant will be added so both the grinder and mill and be operated continuously. The tractor will then be utilized to move and feed biomass with a bale feeder.

The pellet mill will be similar to model TTC2300 Nighthawk (http://www.nighthawkmfg.com/). As noted above, this project will collaborate with Federal Machine and invite them to submit their mill for comparative illustration. Specifications for a comparable grinder were not found by the deadline for grant submission, but cost is expected to be similar. The trailer is a gooseneck style which permits towing with a state-leased truck. The trailer has two 20,000 lb axles which

will permit legal hauling of the tractor, machines, miscellaneous equipment, and a bale of biomass for demonstration.

Instrumentation on the trailer will monitor incoming product quality, process flows, and quality of pellets produced. Conveyors, fabrication supplies will be added in year two for continuous flow. Bins will be required to contain and store biomass. Steel will be required for general fabrication and mounting of equipment as well as construction of safety shields to protect audience members from power transmission devices and equipment operation.

The Research Associate will have responsibility for construction, testing and demonstration of the mobile display. They will also create the underlying educational materials. While the Research Associate will be knowledgeable and capable of filling in, the Principle Investigator will have primary responsibility for presentation delivery. The Graduate Student will be responsible for completing economic analyses noted earlier.

Tax Liability

As a non-profit state institution of higher learning, NDSU has no outstanding tax liability.

Patents and Rights to Technical Data

NDSU reserves the right to all intellectual property developed as part of this project.

References

Bio Energy and Product Innovation Center, North Dakota State University, viewed April 24, 2009 http://www.ndsu.edu/ndsu/bioopportunities/index.html

"EPA Finds Greenhouse Gases Pose Threat to Public Health, Welfare / Proposed Finding Comes in Response to 2007 Supreme Court Ruling" Environmental Protection Agency, viewed April 24, 2009 http://yosemite.epa.gov/opa/admpress.nsf/0/0EF7DF675805295D8525759B00566924

"Alternative Fuels and Advanced Vehicle Data Center" U.S. Dept of Energy, viewed April 24, 2009 http://www.afdc.energy.gov/afdc/sabre/sabre.php?state=north-dakota

Appendices

United States Department of Agriculture

Research, Education and Economics
Agricultural Research Service

April 29, 2009

TO: Dr. Cole Gustafson

SUBJECT: Support for Biomass Demonstration Unit Proposal

The USDA-ARS Northern Great Plains Research Laboratory (NGPRL) has been working on the development of new cropping systems that incorporate perennial crops in otherwise annual cropping systems. We have entered into a research collaborative relationship with the North Dakota State University BioEnergy and Products Innovation Center (EPIC). This relationship is necessary to 1) develop sustainable agricultural systems that support biomass crops, 2) handle bulky biomass products post-harvest, and 3) develop process to convert biomass to energy. With these objectives in place we eagerly support the efforts of EPIC to acquire funding toward the development of a small biomass demonstration unit and the subsequent follow-up educational program to inform producers of opportunities related to biomass production.

Sustainability of agricultural production systems is of primary importance to the regional economy. Expanding interest and growth in biobased energy, bioproducts, and other emerging technologies will create multiple economic and environmental tradeoffs for the North Dakota family farmer. The distinctiveness of these risks and benefits are not well understood. To excel in creating new sustainable production systems involving family farmers in U.S. and global energy and industrial raw material production, successful collaboration and communication between federal and state research organizations becomes essential. The collaboration of scientific organizations will provide opportunities for broader impact and greater significance for North Dakota family farmers.

To that end, NGPRL is will provide office space, laboratory space, staff services, and equipment for the support an NDSU Bioprocess Engineer. Specifically, USDA-ARS will provide:

Item	Approximate Value
Office	$4,200/yr
Laboratory	$30,000/yr
Basic Laboratory Equipment	$10,000/yr
Use of Feedstock Processing Equipment	$15,000/yr
Telephone/Internet Access	$2,400/yr
Staff Services	$2,000/yr
2-year Total In-Kind Contribution	$127,200

Through this collaborative effort, we will enhance the capacity of our two organizations to develop environmentally sound practices and add value to agricultural systems in the Great Plains

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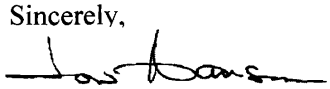
An Equal Opportunity Employer

in terms of food, feed, and biomass by conducting team-focused, systems-oriented research and technology transfer.

Sincerely,



Dr. Jon D. Hanson
Laboratory Director NGPRL

NORTH DAKOTA
Farmers Union

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April 27, 2009

Dr. Cole R. Gustafson
Co-Director, BioEnergy and Products Innovation Center
Professor, Agribusiness and Applied Economics
NDSU Dept 7610
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Fargo ND 58108-6050

Dear Dr. Gustafson:

North Dakota Farmers Union is the state's largest general farm organization with more than 42,000 member families. NDFU works through the legislative process to develop economic and social policies, provides services to start and sustain cooperatives and related initiatives, and offers educational programs to benefit farmers, ranchers and rural communities.

North Dakota Farmers Union (NDFU) is committed to providing $1,000 matching funds and highly supports your grant proposal "Biomass Processing, A Mobile Demonstration and Education Program" being submitting for funding consideration to the North Dakota Industrial Commission.

NDFU was an integral partner in the Great River Energy biomass assessment study for the Spiritwood project and hosted several focus groups of producers to determine production and supply feasibility. As you note, substantial voids exist in producer understanding of the process for converting biomass to a renewable energy form desired by end-users. In addition, you carefully observe that farmers and ranchers learn best from demonstrations and other hands-on experiences in settings that resemble their local operating environments.

For these reasons, creation of a biomass processing educational program and mobile demonstration plant is timely. NDFU is one of the nation's leading providers of carbon credits, and the market for additional biomass renewable energy will no doubt continue to increase. It is imperative that North Dakota farmers and ranchers become aware of this opportunity so the state can be a leading provider of biomass feedstocks.

Sincerely,

NORTH DAKOTA FARMERS UNION

Robert L. Carlson
President