



GREAT RIVER  
ENERGY®

---

17845 East Highway 10 • P.O. Box 800 • Elk River, Minnesota 55330-0800 • 763-441-3121 • Fax 763-241-2366

December 1, 2007

Karlene Fine  
Executive Director  
North Dakota Industrial Commission  
State Capital – 14<sup>th</sup> Floor  
600 East Boulevard Ave Dept 405  
Bismarck, ND 58505-0840

Transmittal Letter: "Feasibility Study of a Biomass Supply for the Spiritwood Industrial Park"

Dear Ms. Fine:

Enclosed please find the above referenced project proposal which Great River Energy, Great Plains Institute, North Dakota Natural Resources Trust, North Dakota Farmer's Union and North Dakota Association of Rural Electric Cooperatives are submitting for consideration by the North Dakota Renewable Energy Council.

This transmittal letter represents a binding commitment by Great River Energy, and the parties for completion of the project as described in the proposal.

Sincerely,

GREAT RIVER ENERGY

Sandra Broekema  
Manager, Business Development

**Transmittal Letter – see attachment**

## **Title Page**

**Project Title:** *Feasibility Study of a Biomass Supply for the Spiritwood Industrial Park*

**Lead Applicant:** *Great River Energy*

**Co-applicants:**

- *Great Plains Institute*
- *North Dakota Association of Rural Electric Cooperatives*
- *North Dakota Department of Agriculture*
- *North Dakota Farmers Union*
- *North Dakota Natural Resources Trust*

**Principal Investigator:** *Sandra Broekema, Great River Energy*

**Date of Application:** *December 1, 2007*

**Amount of the Request:** *\$109,000*

## **Table of Contents**

<b>Abstract</b>	<b>page 4</b>
<b>Project Description</b>	<b>page 5</b>
<b>Standards of Success</b>	<b>page 10</b>
<b>Background/Qualifications</b>	<b>page 11</b>
<b>Management</b>	<b>page 13</b>
<b>Timetable</b>	<b>page 13</b>
<b>Budget</b>	<b>page 13</b>
<b>Tax Liability</b>	<b>page 14</b>
<b>Confidential Information</b>	<b>page 14</b>
<b>Patents and Rights to Technical Data</b>	<b>page 15</b>
<b>Appendices</b>	<b>page 15</b>

## **Abstract**

This project will perform a detailed technical evaluation of the prospects for integrating a biomass supply into Spiritwood Station, part of the new Spiritwood industrial park in Jamestown, North Dakota. Great River Energy (GRE) proposes to co-fire up to 10 percent biomass in Spiritwood Station. GRE has already made additional investments in engineering, and it plans to add additional ports to the boiler to allow for biomass co-firing.

This project will evaluate the types of biomass that might be delivered to the project and the delivered cost of biomass from various sources, including such factors as production, on-field handling and baling, loading, transportation, and on-site handling. It will evaluate densification options to identify the lowest cost strategy for transportation and logistics, and develop a detailed project budget and process schematic for supplying biomass to the project. Finally, it will evaluate the prospects for recruiting existing farmland into perennial energy crops. The final outcome of the project will be to allow GRE to run biomass supply numbers into its pro forma model for the project and make decisions about which types of biomass to integrate into the project.

This project will be conducted through a partnership of industry, wildlife conservation groups, agricultural interests, and the financial community that have been meeting for the past year to evaluate opportunities to promote conservation-friendly bioenergy projects and to develop a commercial business model for best practice biomass production and utilization.

If successful, this project could help Spiritwood Station demonstrate a new model of renewable energy production, provide additional value to agricultural producers and rural communities, and offer a replicable example for other coal-fired power plants in North Dakota.

## **Project Description**

The objective of this project is to perform a detailed technical evaluation of the prospects for integrating a biomass supply into Spiritwood Station, part of the new Spiritwood industrial park in Jamestown, North Dakota. The industrial park will include a 99 MW coal fired power plant, a 100 million gallon ethanol plant, and an expanded Cargill malt processing plant. The overall project will cost \$500 million, with the Spiritwood Station itself costing \$276 million. This will be the first combined heat and power project in the state of North Dakota. As a CHP plant, it will achieve far greater efficiency than a plant producing only electricity.

Great River Energy is interested in co-firing up to 10 percent biomass in the Spiritwood Station. They have already made additional investments in engineering, and they plan to add additional ports to the boiler to allow for biomass co-firing. This project will provide a detailed evaluation of the technical feasibility and economics of supplying biomass to the facility from various sources. If successful, the Spiritwood Station could demonstrate a new model of renewable energy production, provide additional value to the local community, and potentially offer a replicable model for other coal-fired power plants in North Dakota.

This project will be conducted in collaboration with a partnership of industry, wildlife conservation groups, agricultural interests, and the financial community that have been meeting for the past year to evaluate opportunities to promote conservation-friendly bioenergy projects.

On behalf of this initiative, the North Dakota Natural Resources Trust has also sought funding from the Bush Foundation. Where this grant to the ND Renewable Energy Council focuses on project feasibility, the Bush grant addresses the following:

- Assessing agricultural producer interest in production, harvest, densification, and transportation of biomass;

- Developing draft Best Management Practices (BMPs)/sustainability criteria for a grass biomass system; and
- Building a foundation for future assessments and modeling of a grass biomass system and relationships to wildlife habitat and populations; carbon and nitrogen fluctuations and biogeochemical cycles; soil erosion, sedimentation, compaction and health; and greenhouse gas flux in soils. Information gained from these studies will be used to revise BMPs, as appropriate.

The Great Plains Institute, again on behalf of this project, has requested funding from the Joyce Foundation to provide general support to the overall partnership described above. This partnership of industry, farm and conservation organizations, and state government has proposed four biomass projects—this project among them—that, over a decade, will scale up sustainable biomass feedstock production, harvest, and delivery to the point where co-gasification of perennial grass biomass with coal becomes financially and logistically feasible. Beyond the Spiritwood project described in this proposal, other early projects such as producing and delivering perennial grass on a small scale to offset natural gas at a conventional corn ethanol plant are being pursued to help set the stage for subsequent larger-scale biomass co-gasification with coal. The Joyce Foundation funding will support the implementation of this Spiritwood project and the others by enabling a key group of stakeholders from industry, conservation groups, state government and the research community to work collaboratively and by providing an information-sharing venue to allow the sharing and broader application of what is learned from the various projects.

**Objectives for the North Dakota Renewable Energy Council grant:**

- Evaluate the types of biomass that might be delivered to the project based upon:

- Overall supply;
- Likely delivered cost; and
- Suitability for use based upon moisture content, energy content, ash and mineral content, handling characteristics and other factors
- Evaluate the delivered cost of biomass from various sources, including such factors as production, on-field handling and baling, loading, transportation, and on-site handling.
- Evaluate densification options to identify the lowest cost strategy for transportation and logistics.
- Develop a detailed project budget and process schematic for supplying biomass to the project, including:
  - Payments to landowners for biomass;
  - Equipments needs anywhere in the biomass supply chain; and
  - Detailed description of every step in the supply chain, from field to processing plant.
- Evaluate the prospects for recruiting existing farmland into perennial energy crops, in particular estimating the break-even cost necessary to encourage a landowner to consider switching from conventional crops to perennial energy crops, with all the attendant soil health, water quality, habit and soil carbon sequestration benefits. Identify policy and other barriers, and make recommendations on how to overcome them.

**Methodology:**

In determining biomass supply estimates, the study will rely on published data on crop production to estimate crop residue supply, data on Conservation Reserve Program land to determine supply of perennial grass biomass and surveys of nearby agricultural processing plants



to determine supply of biomass in the form of plant waste. Supply estimates will likely be based upon a combination of spreadsheet models and GIS analysis.

The economics of biomass production and logistics, and the detailed budget and process schematic will be based on published reports on other recent biomass projects in the U.S., and will also require original engineering studies.

**Expected Results:**

At the end of the study period, Great River Energy should have enough information to begin developing a biomass supply for the Spiritwood Station. They should have a clear understanding of the relative cost and other attributes of various biomass options, and be able to decide what types of biomass to focus on.

After one year, GRE will enter data from this analysis into their pro forma model for the Spiritwood Station project and evaluate the overall impact on project costs, both from potentially higher cost biomass, and from potential additional revenue from renewable energy credits and carbon credits.

The study should also provide a basis for planning other biomass energy projects in the state of North Dakota.

**Facilities:**

Not applicable, since this is a grant for a study

**Resources:**

This project will primarily rely on staff of Great River Energy, partner institutions, and project consultants.

**Techniques to be used:**

See methodology above.

**Environmental and Economic Impacts of the Project:**

Incorporating a biomass supply into the Spiritwood Station should enhance an already environmentally beneficial project.

The Station itself, because it is a combined heat and power plant, has dramatically higher efficiency than a standard coal-fired power plant. This means that emissions per unit of electricity are lower. The Industrial Park's ethanol plant will produce a fuel that has been demonstrated to improve air quality.

Adding a biomass component will have multiple benefits. Co-firing biomass with coal has been demonstrated to decrease NOx emissions. Incorporating biomass will also decrease greenhouse gas emissions.

Use of perennial biomass would provide multiple environmental benefits, enhancing soil quality, water quality, and wildlife habitat in the surrounding area. To the extent that commercial demand for perennial biomass leads to agricultural land being returned to permanent cover, significant terrestrial carbon sequestration benefits in soils could also be realized.

**Why the project is needed:**

North Dakota has a vast potential supply of biomass, and leads the nation in potential supply of perennial energy crops. While great potential exists to produce cellulosic ethanol and other liquid fuels, attracting such projects to North Dakota will depend on demonstrating that perennial biomass and other sources of biomass can feasibly and economically be delivered to an energy plant.

At the same time, North Dakota's electric utilities are considering various ways to satisfy consumer demand for renewable energy, and deal with possible regulatory requirements in the future for reducing greenhouse gas emissions.

This project is important in that it will evaluate the possibility of demonstrating a biomass supply using a commercially proven technology. It will also provide a replicable model for renewable energy and decreasing greenhouse gases that may be useful for other future projects.

### **Standards of Success**

The project will be successful if it meets the following criteria:

- **Replicable:** This project should provide information that is useful to Great River Energy and other utilities in determining how to use biomass as a source of renewable energy. If this project is successful, it should lead to other similar projects around the state.
- **Public Education:** This project should provide a clear picture to the surrounding community of the impacts of a biomass project, including new employment, opportunities to produce and sell biomass, and potential benefits to soil, water, and wildlife from increased acreage in perennial cover to supply perennial crop biomass to the project.
- **Economic development:** This project should provide multiple economic opportunities, including: production and sale of biomass, sale of equipment for the project, construction, and other jobs.
- **Innovation:** This project should evaluate the opportunity to use biomass in a way that would be unique in North Dakota.
- **Economic and technical feasibility:** The primary purpose of this grant is to determine whether this project is an economic, efficient, and environmentally sound way to use biomass.
- **Decision on whether to proceed:** After one year, GRE should have adequate supply and cost data that they can run through their pro forma model to determine the impact on the

overall cost of the project. There may be certain additional costs for the biomass relative to coal, but there may also be offsetting benefits from renewable energy credits and soil carbon credits. On the positive side of the ledger, GRE would like to be able to share economic benefits of the project with its distribution cooperatives and their members.

## **Background/Qualifications**

### **Great River Energy**

Great River Energy is a not-for-profit wholesale electric cooperative, serving 28 distribution cooperatives in Minnesota and covering 60 percent of the state geographically. It is the second largest power supplier in Minnesota. Great River Energy owns and operates two power plants in North Dakota: Stanton Station, located near Stanton, ND, and operational since 1966 and Coal Creek Station, located near Underwood, ND and operational since 1979.

GRE has made important commitments to renewable energy development, including a waste-to-energy plant at its headquarters in Elk River, MN, a landfill gas project in Elk River, MN, anaerobic digestion projects in Princeton and St. Peter, MN, four wind projects in MN totaling 118 MW with plans for an additional 100 MW, and hydroelectric power.

### **Great Plains Institute**

The Great Plains Institute served as the lead on a US Department of Energy funded project evaluating the use of perennial energy crops in the Dakotas and Minnesota. The \$800,000 multi-state and multi-year project was a partnership with South Dakota State University, University of North Dakota – EERC, and the University of Minnesota. The project included an analysis of production costs, overall resource, and transportation costs to produce a biomass supply in North Dakota.

The Great Plains Institute for Sustainable Development, INC. is registered as a Foreign Nonprofit Corporation in active and good standing with the North Dakota Secretary of State.

### **North Dakota Natural Resources Trust**

The North Dakota Natural Resources Trust is dedicated to the preservation, enhancement, restoration and management of wetlands and associated wildlife habitat, grasslands, and riparian areas in the state of North Dakota. The Trust's broad constituency is made up of private landowners, agricultural producers, outdoor users, conservation and environmental groups, agricultural groups, and policy makers at both the state and federal level.

In 2006, the North Dakota Natural Resources Trust received a Natural Resources Conservation Service grant to evaluate perennial herbaceous biomass crops. The study will determine appropriate grass and legume species, harvest methods, and practices to maintain productive perennial biomass stands.

### **North Dakota Farmers Union**

North Dakota Farmers Union, the largest general farm organization in the state, has been interested in the issues of renewable energy for years, and policy adopted by its members in recent years supports research and development of all kinds of renewable fuels, especially if non-traditional feedstocks can be utilized. NDFU has actively supported long-term research projects through ND Natural Resources Trust specifically aimed at studying whether various cultivars of switchgrass are suited to the northern plains.

ND Farmers Union manages the carbon credit program for National Farmers Union, and has over three million acres of no-till, seeded grasses, and managed rangeland enrolled for carbon offsets trading through the year 2010, and will continue to be a leader in helping producers market greenhouse gas offsets.

### **North Dakota Association of Rural Electric Cooperatives**

Since 1990, The North Dakota Association of Rural Electric Cooperatives has operated a rural development program that provides technical assistance in support of the development of cooperatives and other rural businesses. This technical assistance includes guidance through the organizational development phase, start-up administrative services, grant writing, facilitating equity drives, conducting feasibility studies and developing financing packages. In addition, NDAREC publishes a magazine, *North Dakota Living*, which reaches 86,000 rural North Dakota residents. The magazine is used as a tool to communicate and promote rural development projects to rural residents. NDAREC will partner with this project to help organize farmers to deliver the biomass to the facility and to communicate the efforts to rural residents in the state.

**Management**

Great River Energy will serve in a leading role in managing this study, including managing any personnel at partner institutions and any consultants brought in to assist in the analysis. The study team will develop a detailed project plan in cooperation with assure that objectives are completed in a timely fashion.

**Timetable**

June 2008: Project partners agree on a final timeline, team is assigned to complete all major work products

April 2009: Draft report submitted to project partners for review and input

June 2009: Final report completed

**Budget**

<b>Funding sought from the NDREC</b>	
<b>Task</b>	<b>Dollar amount</b>
Project Management	\$9,000
Biomass supply evaluation	\$18,000
Estimate of delivered cost of biomass from various sources	\$24,000
Comparison of densification strategies for biomass	\$18,000

Development of biomass supply budget and supply chain process schematic	\$18,000
Evaluate prospects for land conversion to energy crops, evaluating costs and barriers	\$12,000
<b>Other costs</b>	
Meetings	\$5,000
Travel	\$5,000
<b>Total Funding Request</b>	\$109,000
<b>Matching Funding</b>	
<b>Great River Energy</b>	
Cash match – Biomass Feasibility analysis	\$25,000
In kind match – Pro Forma Analysis using study results, additional engineering to allow biomass co-firing, additional ports in boilers to allow biomass co-firing	\$100,000
<b>North Dakota Natural Resources Trust/Bush Foundation (proposed)</b>	
Cash match – Biomass Feasibility analysis	\$50,000
In kind match – Environmental impacts, best management practices development, community impacts, producer surveys	\$150,000
<b>Great Plains Institute/Joyce Foundation (proposed)</b>	
Cash Match – Biomass Feasibility analysis	\$50,000
In kind match – Management of multi-stakeholder Native Grass Biomass Initiative	\$50,000
<b>Total Cash Match</b>	\$125,000
<b>Total In-kind Match</b>	\$300,000

### **Other Contributions**

North Dakota Farmers Union:

- Meeting rooms, other facilities, meal functions for necessary meetings as a part of this project.
- Staff office support for various meetings and seminars related to this project.
- Knowledge of current legislation and initiatives relating to renewable energy, climate change issues, and the emerging field of environmental trading and emissions credits

North Dakota Association of Rural Electric Cooperatives:

- NDAREC will partner with this project to help organize farmers to deliver the biomass to the facility and to communicate the efforts to rural residents in the state.

**Tax Liability**

Please see attachment.

**Confidential Information**

The Biomass Supply for Spiritwood Project Partners do not believe that any of the information submitted with this application needs to be handled as confidential by the NDIC; however some of the results of the feasibility study may be regarded as confidential. This includes both technical information which might be of a proprietary nature and certain economic results and models. There is also confidential data in the pro forma model for the overall Spiritwood Project. The Partners will address each item that is requested to be kept as confidential in the interim and final reports as they are submitted to the NDIC. There will be confidential data in the pro forma model for the overall project.

**Patents and Rights to Technical Data**

Great River Energy wishes to reserve the right to Patent any Intellectual Property coming out of this study.

**Appendices**

None.





GREAT RIVER  
ENERGY®

---

17845 East Highway 10 • P.O. Box 800 • Elk River, Minnesota 55330-0800 • 763-441-3121 • Fax 763-241-2366

November 30, 2007

To Whom It May Concern:

Great River Energy is not delinquent in any tax liability to the State of North Dakota or any of its political subdivisions.

Sincerely,

GREAT RIVER ENERGY

Douglas J. Paumen  
Controller