

**Contract No. R001-003**

**“Feasibility Study of a Biomass Supply for the Spiritwood Industrial Park”**

Submitted by Great River Energy along with the following five 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

**PARTICIPANTS**

<b>Sponsor</b>	<b>Cash Cost Share</b>	
Great River Energy	\$ 34,179	
Great Plains Institute	\$ 50,000	
Other Partners	\$ 15,292	
North Dakota Industrial Commission	<u>\$ 95,000</u>	
Cash Total	\$194,471	
	<b>In-Kind Cost Share</b>	
Great River Energy	\$125,000	
North Dakota Natural Resources Trust	\$ 25,000	
Great Plains Institute	\$ 50,000	
North Dakota Farmers Union	\$ 10,000	
North Dakota State University	\$ 16,000	
ND Rural Electric Cooperatives	\$ 10,000	
North Dakota Game and Fish Dept.	\$ 15,000	
U. S. Fish & Wildlife	<u>\$ 5,000</u>	
In-Kind Total	\$256,000	
Total Project Cost		\$450,471

Project Schedule – 12 months  
Contract Date – July 28, 2008  
Start Date – July 1, 2008  
Completion Date – June 30, 2009

Project Deliverables:  
Status Report: October 31, 2008 v  
Draft Final Report: April 30, 2009 v  
Final Report: June 30, 2009 v

## **OBJECTIVE/STATEMENT OF WORK:**

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. 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, raw material 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.

Note: Portions of the status and final reports will be confidential.

## **STATUS**

Work has been completed and final report is posted on the Industrial Commission Renewable Energy Program website. The project came in under budget and the Industrial Commission's commitment to the project was reduced to \$95,000. The Executive Summary from the Final Report states:

### **I. Executive Summary**

The purpose of the Biomass Co-firing Feasibility Assessment is to ascertain whether a sustainable biomass business model can be developed in the area of Spiritwood, North Dakota. As a potential purchaser of biomass fuel, Great River Energy finds itself in a classic chicken and egg situation. There is no established biomass supply chain because the market does not exist and no market because the supply chain does not exist.

The primary driver for Great River Energy's interest in co-firing biomass is to reduce future emissions of carbon dioxide (CO<sub>2</sub>). Co-firing biomass offers a one for one emission offset for

every ton of coal displaced. As the cost of emitting CO<sub>2</sub> increases in the future, co-firing biomass could provide a real opportunity to maintain or reduce costs for energy consumers.

This study aims to evaluate the specific types of biomass that may readily exist or be established in the future, along with co-firing characteristics, and likely delivered costs. From a prospective producer standpoint, the study lays out a process schematic for the biomass harvest and delivery business model along with tools to help evaluate the economic costs and benefits of entering this market.

A diverse team of stakeholders has been assembled to work on this project and university researchers have been subcontracted for these specific tasks:

- \* Inventory of biomass within a 50 mile radius of Spiritwood, ND
- \* Matrix showing delivered costs and suitability for co-firing
- \* Densification options and costs
- \* Process schematic for biomass supply chain
- \* Prospects for recruiting existing farmland and CRP into dedicated energy crops
- \* Producer Economic Model for evaluating alternative cropping scenarios

Table 1 - Top 5 Biomass Sources for Spiritwood, North Dakota

<b>Biomass</b>	<b>TPY (% available)</b>	<b>BTU/lb</b>	<b>Delivered Cost \$/dry ton</b>	<b>\$/MMBtu</b>
Corn cobs	400,000 (17.5%)	6,900	50	3.60
<i>Grasses CRP</i>	<i>3,500,000 (2%)</i>	<i>7,500</i>	<i>50</i>	<i>3.80</i>
Corn stover	1,200,000 (5.8%)	6,600	50	3.60
Wheat straw	690,000 (10%)	7,000	50	3.35
Beet foliage	100,000 (70%)	7,000	42	3.00

With estimated delivered cost of biomass at \$40 to \$80 per ton (\$3 to \$4/MMBtu), biomass co-firing can be cost effective at CO<sub>2</sub> costs above \$25/metric tonne. In addition to developing a biomass supply infrastructure for co-firing up to 10 percent biomass at Spiritwood Station, there is significant potential for supplying 100 percent biomass feedstock to cellulosic biofuels or industrial biochemical plants that may elect to locate in North Dakota.

Updated 8/17/09