

May 1, 2008

Ms. Karlene Fine  
Executive Director  
North Dakota Industrial Commission  
ATTN: Renewable Energy Development Program  
600 East Boulevard Avenue  
State Capitol, 14th Floor  
Bismarck, ND 58505-0840


Dear Ms. Fine:

Subject: Energy & Environmental Research Center Proposal No. 2008-0292 Entitled  
“Development of Economically Sustainable Distributed Power from Biomass  
Gasification for North Dakota”

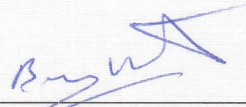
Enclosed please find an original and one copy of the subject proposal and the \$100 application fee. Also enclosed is a letter that serves as EERC’s commitment to complete the project.

If you have any questions, please contact me by telephone at (701) 777-5261 or by e-mail at [dphassett@undeerc.org](mailto:dphassett@undeerc.org).

Sincerely,

  
Debra F. Pflughoeft-Hassett  
Senior Research Advisor

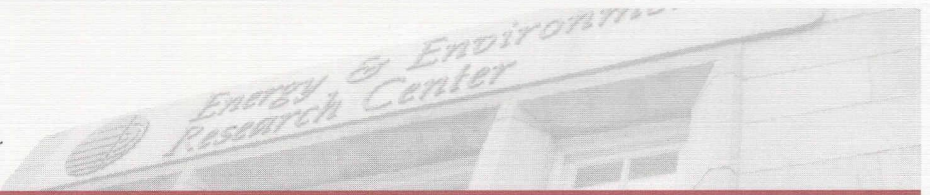
Approved by:

  
\_\_\_\_\_  
Dr. Barry I. Milavetz, Associate VP for Research  
Research Development and Compliance

DFPH/cs

Enclosures

c/enc: Jeff Burgess, NDIC



# DEVELOPMENT OF ECONOMICALLY SUSTAINABLE DISTRIBUTED POWER FROM BIOMASS GASIFICATION FOR NORTH DAKOTA

EERC Proposal No. 2008-0292

*Submitted to:*

**Karlene Fine**

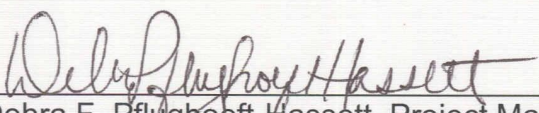
**North Dakota Industrial Commission  
ATTN: Renewable Energy Development Program  
600 East Boulevard Avenue  
State Capitol, 14th Floor  
Bismarck, ND 58505-0840**

Amount Requested: \$50,000


*Submitted by:*

Debra F. Pflughoeft-Hassett  
Darren D. Schmidt

Energy & Environmental Research Center  
University of North Dakota  
15 North 23rd Street, Stop 9018  
Grand Forks, ND 58202-9018



Debra F. Pflughoeft-Hassett, Project Manager



Dr. Barry I. Milavetz, Associate VP for Research  
Research Development and Compliance

May 1, 2008

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# **DEVELOPMENT OF ECONOMICALLY SUSTAINABLE DISTRIBUTED POWER FROM BIOMASS GASIFICATION FOR NORTH DAKOTA**

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## **ABSTRACT**

The Energy & Environmental Research Center (EERC) proposes to demonstrate biomass gasification in an effort to educate potential North Dakota users. The project will use an existing 50-kW gasification system in Grand Forks, North Dakota, and will demonstrate long-term operation of the system for heat and power at the existing facility and short-term testing of additional biomass fuels for interested parties. The project will make potential North Dakota gasification users aware of the environmental and economic benefits of installing and operating a gasification system to replace a portion or all their current energy consumption.

The overall goals of the effort are to demonstrate long-term heat and power generation through biomass gasification and to educate North Dakota entities on the opportunities for use of local biomass for heat and power generation for small industrial and agricultural operations. The project will include long- and short-term demonstration tasks, development of educational materials, and reporting. Results will include the development of long-term test data for biomass gasification, education of potential industry and agricultural users of biomass gasification, short-term testing of a variety of North Dakota biomass fuels, and development of new gasification systems in North Dakota.

The project is proposed for a 1-year effort, and the total project cost is \$100,000. The EERC requests \$50,000 from the North Dakota Renewable Energy Commission, and the remaining \$50,000 will be provided from a project funded through the Construction Engineering Research Laboratory of the U.S. Army Corps of Engineers.

# **DEVELOPMENT OF ECONOMICALLY SUSTAINABLE DISTRIBUTED POWER FROM BIOMASS GASIFICATION FOR NORTH DAKOTA**

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## **PROJECT DESCRIPTION**

The Energy & Environmental Research Center (EERC) has developed a biomass power system that utilizes gasification to provide a clean producer gas for thermal or electrical production applications. The biomass gas can be fired in a burner/boiler for heat or fired in an engine generator to produce power with the option of combined heat and power. The EERC gasification system is 50 kW and is located at an industrial facility in Grand Forks, North Dakota. The gasifier and associated systems have been tested, and heat and power have been produced. Electricity has also been produced and fed back into the grid as a demonstration. The gasification system components were manufactured by a local North Dakota company.

The EERC proposes to continue operation of the existing 50-kW gasification system in order to demonstrate the long-term operation of the system for heat and power at the existing facility and to facilitate the continued development of small biomass-based gasification for industrial and agricultural users in North Dakota. Since many industrial and agricultural entities have access to biomass for fuel use and a need for heat and power, it is proposed to make these potential users aware of the benefits of installing and operating a gasification system to offset some of their current energy consumption. The demonstration unit will be available to allow interested parties to learn about gasification and the associated systems used to prepare and introduce biomass fuels, to utilize the low-Btu synthetic gas produced, and to appropriately manage the by-product outputs of the system. Interested parties will also be invited to supply biomass available to them for testing in the gasifier. The proposed project will also provide the

opportunity to perform continued evaluation of the emissions, solid by-products, and wastewater handling for small gasifiers.

## **OBJECTIVES**

The overall goals of the effort are to demonstrate long-term heat and power generation through biomass gasification and to educate North Dakota entities on the opportunities for use of local biomass for heat and power generation for small industrial and agricultural operations. Supporting objectives are to demonstrate the gasification of specific biomass feedstocks as an evaluation of fuel appropriateness and operational issues and to develop increased information of the use and maintenance of the gasification system for long-term use.

## **METHODOLOGY**

### **Task 1 – Demonstrate Long-Term Operation of Biomass Gasification**

Using the existing 50-kW gasification system in Grand Forks, North Dakota, the operation of the system with on-site wood waste fuel will be demonstrated for 3 months, with appropriate maintenance. Operation and maintenance procedures will be documented, including emission testing for 1 week of testing, recycle rate of char, final disposition of solid by-product, and wastewater production and management. Heat and power will be used on-site, or electricity will be fed to the grid depending on the on-site needs. The facility will be available for viewing by interested parties during this long-term testing. Results of this testing will be reported to the North Dakota Renewable Energy Commission and other interested parties.

### **Task 2 – Demonstrate Use of North Dakota Biomass Fuels**

Potential users of biomass fuels and gasification will be identified using available resources at the EERC and will be provided with information on the opportunities for biomass gasification. Interested parties will be invited to view the Grand Forks gasification system where additional information will be provided during the on-site visit. Discussions will be held regarding the technical and economic

appropriateness of gasification for their specific site, fuel, and heat and power needs. Selected parties will be invited to provide biomass fuels for testing at the Grand Forks facility. Up to five biomass fuels are expected to be tested for 1-week tests. Results will be provided to the biomass fuel supplier, and preliminary design and economic evaluation information will be developed for the site of interest. On conclusion of the proposed five biomass fuel tests, the results will be assembled and made available to the North Dakota Renewable Energy Commission and other interested parties in North Dakota.

### **Task 3 – Develop Educational Materials**

The information assembled in Tasks 1 and 2 will be used to prepare educational materials for potential users of biomass gasification in North Dakota. It is anticipated that the material will include a workbook for potential users to conduct a self-assessment for the technical and economic appropriateness of biomass gasification for a specific site requiring input estimates of biomass available and heat and power needs.

### **Task 4 – Reporting**

- Quarterly reports submitted during the month following the end of the calendar quarter.
- Report of results of Task 1 long-term biomass gasification demonstration.
- Report of results of Task 2 individual testing for interested North Dakota parties.
- Educational materials, including a preliminary workbook for potential biomass gasification users.
- Comprehensive final report on conclusion of the effort.

### **ANTICIPATED RESULTS/IMPACT**

- Potential industry and agricultural users of biomass gasification will be educated on the benefits, costs, operation, and maintenance of biomass gasifiers for on-site heat and power generation.
- North Dakota biomass feedstocks will be evaluated in the existing gasification demonstration unit.



- The fabricators of the gasification system will initiate contracts with one or more industrial or agricultural users for implementation of biomass gasification in North Dakota.
- Emission, by-product, and wastewater management plans will be prepared and made available to potential users.

## **FACILITIES, RESOURCES, AND CAPABILITIES**

The EERC has developed a biomass power system that utilizes gasification to provide a clean producer gas for thermal or electricity production applications. The biomass gas can be fired in a burner/boiler for heat or fired in an engine generator to produce power with the option of combined heat and power. The EERC has supporting emission testing instrumentation that can be installed at the current facility and laboratory capabilities at the EERC to evaluate fuels, wastewater, and solid by-products. The EERC employs several operators who have been trained to operate and maintain the gasification system. The gasification system was designed by EERC research engineers who are also available to evaluate data from the system and troubleshoot technical issues during the long-term operation of the facility.

In a report to the North Dakota Forest Service (Schmidt et al., 2003), the EERC reported that 6.5 million tons of biomass is potentially available for energy production in North Dakota. In another effort, the EERC provided support to the North Dakota Forest Service to evaluate the potential for biomass to be used in the Fuels for Schools Program (Schmidt and Leroux, 2006) and found that biomass combustion was a viable solution for some schools in North Dakota. Background information from these studies will facilitate an understanding of the opportunities for biomass gasification in North Dakota, and the effort proposes to use the Grand Forks gasifier to provide a learning opportunity similar to the Fuel for Schools Program, where biomass combustion systems located at individual schools demonstrated biomass use and familiarized other schools in the region with the technology requirements.

## ENVIRONMENTAL AND ECONOMIC IMPACTS

The environmental and economic impacts of the project will be determined during the accomplishment of the project and become part of the project deliverables, including the educational materials for potential North Dakota users. However, preliminary information on the environmental impacts was developed under another effort.

**Emission Rates** – For a 50-kW gasification system operating at 8-hour days, equivalent to 2080 hours/year, annual and monthly generation will be 104,000 and 8700 kWh, respectively. Estimated emissions from a 50-kW gasification plant are noted in Table 1.

**Solid Waste** – The ash exiting the gasifier is typically <5% of the fuel input (0.036 lb/kWh). Hot charcoal from the gasifier is quenched and dust controlled. Scrubbing material is also collected, and the charcoal and scrubbing material are fired in a burner. The resulting ash is then collected for landfill disposal or use as fertilizer. Filter material is also used in the process to clean the product gas. The filter material is sawdust-based and, when spent, can be recycled into the gasifier.

**Process Water Requirements** – For a 50-kW system, the makeup water requirement is approximately 25 gallons a day.

**Wastewater** – Liquid residuals are contained within the process and converted thermally.

**Table 1. Expected Emissions for 50-kW Gasifier Fueled with Biomass**

Emission	tons/yr	Rate, lb/kWh
NO <sub>x</sub>	0.7	0.0003
CO	0.8	0.0004
CO <sub>2</sub>	1226	0.6
SO <sub>2</sub>	1.1	0.0005
VOC <sup>1</sup>	Negligible	Negligible
Lead	Negligible	Negligible
Mercury	Negligible	Negligible

<sup>1</sup> Volatile organic compound.

## **RESULTING TECHNOLOGICAL AND ECONOMIC IMPACTS**

### **Technological Impacts**

The project will reduce barriers to the implementation of biomass gasification by providing a long-term demonstration and multiple short-term demonstrations using North Dakota biomass fuels. The long-term demonstration will facilitate a hands-on understanding of the gas engine's needs for use with synthetic gas from biomass gasification. Natural gas engines typically require top-end rebuilds every 2 years, and landfill gas engines require rebuilds every 8 months. Biomass gas is expected to be cleaner and less corrosive than landfill gas. The project will provide data on engine performance firing low-Btu gas. With any new technology, issues related to management of emissions, wastewater, and by-products are raised. The long- and short-term demonstrations will provide the opportunity to document the management of these outputs and provide information to potential users on best management practices. This project is intended to demonstrate the gasification technology, educate potential users, and mitigate risk for future installations. The project will also document long-term operation and maintenance which will provide information on the economics of biomass gasification for potential users.

### **Economic Impacts**

Biomass gasifiers are projected to be viable candidates for small- to moderate-sized industries that have a waste biomass requiring management. Examples of this type of small industry would include agricultural processing industries (such as the grass seed producers in Roseau) and forest product industries (such as G F Truss Inc., where the advanced-stage demonstration was performed). The highest potential user will have a biomass waste that can be used as fuel and will be able to use the power generated by an on-site biomass gasifier.

The proposed project is expected to have a positive economic impact for the industrial facility where long-term testing will be performed. EERC researchers will work with the industry to determine the avoided costs for heat and power during the long-term demonstration. At project end,

additional industrial and agricultural users will initiate the installation of gasifiers, and the economic impact to those users is expected to be positive based on fuel availability, heat and power needs, equipment and installation costs, and operation and maintenance costs. Potential users for this gasifier technology include agricultural products, including food products, and forest products industries in North Dakota.

### **Why This Project Is Needed**

The proposed project is designed to accelerate the acceptance of distributed generation of electricity from biomass by addressing technical and information barriers through demonstration of biomass gasification on a long-term basis at a real-world facility and on a short-term basis to demonstrate viability of other North Dakota biomass fuel resources. The technical issues to be addressed include biomass fuel assessment and preparation, demonstration of biomass gasification for multiple fuels, and distribution of the resulting power to a real-world user. It is expected that the proposed demonstration and educational activities will allow interested parties to become familiar with the technology, evaluate the economics for their specific needs, and potentially invest in a North Dakota-produced distributed power system to optimize the economics of their business and allow them to become more energy self-sufficient.

### **STANDARDS OF SUCCESS**

- Completion of long-term operation and documentation of the biomass gasification system.
- Number of contacts with potential users and types of fuels tested in the gasification system.
- Initiation of gasification systems in North Dakota.

### **BACKGROUND AND QUALIFICATIONS**

#### **EERC Background**

Since its founding in 1951, the EERC has conducted research, testing, and evaluation of fuels and associated combustion and gasification technologies on laboratory- and pilot-scale combustors and

gasifiers with capacities of up to 4.0 million Btu/hr. Analytical techniques and instrumentation are available for the characterization of solid, liquid, and gaseous materials. Under the Center for Biomass Utilization<sup>®</sup> (CBU<sup>®</sup>), the EERC has performed numerous research projects in biomass utilization, including resource assessments on a variety of biomass types, biomass gasification for distributed power, and measurement and management of associated emission and wastes. The EERC has laboratory and field testing capabilities for evaluating fuels, wastes, and emissions. Qualified professionals perform process design activities, technical and economic assessments, construction and operation activities for demonstration units, and training.

### **Technology Background**

Gasification technology is suitable for biomass fuels and provides for simple low-pressure power production while avoiding the costs and complexity of steam-driven electric generation. Gasification is an emerging pathway in the area of renewable fuels, and use of the proposed gasification system has already been demonstrated in an advanced-stage research project. Distributed energy production provides an excellent logistical fit for the biomass energy fuel resources that are produced from many sources throughout the region. The demonstration of biomass gasification is expected to confirm an economic advantage in use of locally available biomass to produce energy as a fuel gas or conversion of the fuel gas to electricity.

### **Qualifications**

Ms. Pflughoeft-Hassett will serve as the EERC project manager and coprincipal investigator. She has performed research at the EERC since 1977 working on studies of the use of biomass and other agricultural by-products, industrial and agricultural waste management, and materials characterization. She has experience and expertise in utilization, characterization, regulation, and marketing of industrial and agricultural by-products and resources. She also has experience in resource assessments, environmental issues and regulation, and technology development. She has also worked on projects assessing environmental impacts of by-product utilization.

Mr. Schmidt will serve as the EERC coprincipal investigator. Mr. Schmidt has been working on biomass energy for 13 years and has authored numerous publications. He previously conducted a 1-MWe biomass gasification demonstration project at Camp Lejeune Marine Corps Base while employed by Research Triangle Institute. Mr. Schmidt has reviewed and researched biomass gasification projects ranging from laboratory research and development reactors to unpublished failed commercial attempts and some successful systems operated within the United States and abroad. Over the past 9 years with the EERC, he has worked with industry by conducting feasibility studies, resource assessments, fuel handling and processing design, environmental permitting, and economic sensitivity analysis. Mr. Schmidt is a registered professional engineer in North Dakota.

EERC's project team also includes research engineers, laboratory analysts, and equipment technicians. EERC support staff will provide procurement, accounting, and office services.

## **MANAGEMENT**

Ms. Debra Pflughoeft-Hassett will be the project manager for the proposed project. Ms. Pflughoeft-Hassett will manage all technical, promotional/educational, and administrative aspects of the effort. Ms. Pflughoeft-Hassett has successfully managed several research efforts for the Lignite Research Council. EERC support offices and staff will assist Ms. Pflughoeft-Hassett in administrative efforts for the project which will include contracting, procurement, scheduling, budget control, and reporting.

## **TIMETABLE**

The period of performance for the proposed effort is July 1, 2008, through June 30, 2009. The period of performance can be modified dependent upon the award schedule and contracting activities. A proposed project time line is shown by project month in Table 2.

## BUDGET

The EERC requests \$50,000 from the North Dakota Renewable Energy Commission to support the proposed effort. The EERC's Construction Engineering Research Laboratory project will provide \$50,000 for the proposed effort. A detailed budget and budget notes are attached.

## TAX LIABILITY

The EERC is part of UND, a tax-exempt entity.

## CONFIDENTIAL INFORMATION

There is no confidential information contained in this proposal.

**Table 2. Proposed Project Time Line**

	1	2	3	4	5	6	7	8	9	10	11	12
Long-Term Demonstration	X	X	X	X	X							
Demonstration of Other North Dakota Biomass Fuels						X	X	X	X	X		
Preparation of Educational Materials								X	X	X	X	
Reporting				Q		Task 1	Q			Q	Task 2	Task 3

## REFERENCES

Schmidt, D.D.; Hanson, S.K.; Martin, K.E. *Identifying Resources and Options to Mitigate the Risk of*

*Wildland Fires in North Dakota*; Final Report for North Dakota Forest Service; EERC

Publication 2003-EERC-06-04; Energy & Environmental Research Center: Grand Forks, ND,

June 2003.

Schmidt, D.D.; Leroux, K.M.B. *North Dakota Forest Service fuels for Schools Feasibility Studies*;

Final Report for United Tribes Technical College; EERC Publication 2006-EERC-06-07; Energy

& Environmental Research Center: Grand Forks, ND, June 2006.

DEVELOPMENT OF ECONOMICALLY SUSTAINABLE DISTRIBUTED POWER FROM BIOMASS GASIFICATION FOR NORTH DAKOTA  
 ND RENEWABLE ENERGY DEVELOPMENT PROGRAM  
 PROPOSED PROJECT START DATE: 7/1/08  
 EERC PROPOSAL #2008-0292

**BUDGET**

CATEGORY	HOURLY			TOTAL			REC SHARE		CERL SHARE	
	Rate	Hrs	Cost	Hrs	Cost	Hrs	Cost	Hrs	Cost	
<b>LABOR</b>										
Pflughoeft-Hassett, D.										
Project Manager	\$ 48.15	309	\$ 14,878	155	\$ 7,463	154	\$ 7,415			
Schmidt, D.										
Principal Investigator	\$ 43.46	64	\$ 2,782	32	\$ 1,391	32	\$ 1,391			
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Senior Management	\$ 64.41	46	\$ 2,963	23	\$ 1,481	23	\$ 1,482			
-----										
Research Scientist/Engineer	\$ 34.31	92	\$ 3,157	46	\$ 1,578	46	\$ 1,579			
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Research Technician	\$ 22.77	42	\$ 956	22	\$ 501	20	\$ 455			
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Technology Dev. Mech.	\$ 28.55	400	\$ 11,421	200	\$ 5,710	200	\$ 5,711			
-----										
Undergrad-Res.	\$ 8.82	60	\$ 529	30	\$ 265	30	\$ 264			
-----										
Technical Support Services	\$ 19.31	30	\$ 579	15	\$ 290	15	\$ 289			
			\$ 37,265		\$ 18,679		\$ 18,586			
Escalation Above Base	0%		\$ -		\$ -		\$ -			
<b>TOTAL DIRECT HRS/SALARIES</b>		1,043	\$ 37,265	523	\$ 18,679	520	\$ 18,586			
Fringe Benefits - % of Direct Labor - Staff	53%		\$ 19,470		\$ 9,759		\$ 9,711			
Fringe Benefits - % of Direct Labor - Undergrad. Research	1%		\$ 5		\$ 3		\$ 2			
<b>TOTAL FRINGE BENEFITS</b>			\$ 19,475		\$ 9,762		\$ 9,713			
<b>TOTAL LABOR</b>			\$ 56,740		\$ 28,441		\$ 28,299			
<b>SUPPLIES</b>			\$ 1,000		\$ 500		\$ 500			
<b>COMMUNICATION - PHONES &amp; POSTAGE</b>			\$ 200		\$ 100		\$ 100			
<b>PRINTING &amp; DUPLICATING</b>			\$ 115		\$ 58		\$ 57			
<b>OPERATING FEES &amp; SVCS</b>										
Fuels & Materials Research Lab.			\$ 2,400		\$ 360		\$ 2,040			
Particulate Analysis			\$ 690		\$ 345		\$ 345			
Process Chem. & Dev. Lab.			\$ 1,780		\$ 890		\$ 890			
Graphics Support			\$ 580		\$ 290		\$ 290			
Shop & Operations Support			\$ 532		\$ 266		\$ 266			
<b>TOTAL DIRECT COST</b>			\$ 64,037		\$ 31,250		\$ 32,787			
<b>FACILITIES &amp; ADMIN. RATE - % OF MTDC</b>		VAR	\$ 35,963	60.0%	\$ 18,750	52.5%	\$ 17,213			
<b>TOTAL PROJECT COST</b>			\$ 100,000		\$ 50,000		\$ 50,000			

Due to limitations within the University's accounting system, bolded budget line items represent how the University proposes, reports and accounts for expenses. Supplementary budget information, if provided, is for proposal evaluation.



**DETAILED BUDGET - EERC RECHARGE CENTERS**

	<b>TOTAL</b>		
Fuels & Materials Research Lab.	Rate	#	\$Cost
Ash Determination	\$32	10	\$ 320
BTU	\$50	10	\$ 500
Moisture %	\$47	10	\$ 470
Proximate Analysis	\$60	10	\$ 600
Sulfur	\$51	10	\$ 510
Subtotal			\$ 2,400
Escalation		0%	\$ -
Total Fuels & Materials Research Lab.			<u>\$ 2,400</u>
<hr/>			
Particulate Analysis	Rate	#	\$Cost
Gas Analyzer Maintenance (Daily)	\$69	10	\$ 690
Subtotal			\$ 690
Escalation		0%	\$ -
Total Particulate Analysis			<u>\$ 690</u>
<hr/>			
Process Chemistry. & Dev. Lab.	Rate	#	\$Cost
Prep/GC/CHN	\$89	20	\$ 1,780
Subtotal			\$ 1,780
Escalation		0%	\$ -
Total Process Chemistry & Dev. Lab.			<u>\$ 1,780</u>
<hr/>			
Graphics Support	Rate	#	\$Cost
Graphics (hourly)	\$58	10	\$ 580
Subtotal			\$ 580
Escalation		0%	\$ -
Total Graphics Support			<u>\$ 580</u>
<hr/>			
Shop & Operations Support	Rate	#	\$Cost
Technical Development Hours	\$1.33	400	\$ 532
Subtotal			\$ 532
Escalation		0%	\$ -
Total Shop & Operations Support			<u>\$ 532</u>

## BUDGET NOTES

### ENERGY & ENVIRONMENTAL RESEARCH CENTER (EERC)

#### BACKGROUND

The EERC is an independently organized multidisciplinary research center within the University of North Dakota (UND). The EERC receives no appropriated funding from the state of North Dakota and is funded through federal and nonfederal grants, contracts, and other agreements. Although the EERC is not affiliated with any one academic department, university faculty may participate in a project, depending on the scope of work and expertise required to perform the project.

#### INTELLECTUAL PROPERTY

If federal funding is proposed as part of this project, the applicable federal intellectual property (IP) regulations may govern any resulting research agreement. In addition, in the event that IP with the potential to generate revenue to which the EERC is entitled is developed under this agreement, such IP, including rights, title, interest, and obligations, may be transferred to the EERC Foundation, a separate legal entity.

#### BUDGET INFORMATION

The proposed work will be done on a cost-reimbursable basis. The distribution of costs between budget categories (labor, travel, supplies, equipment, etc.) is for planning purposes only. The project manager may, as dictated by the needs of the work, incur costs in accordance with Office of Management and Budget (OMB) Circular A-21 found at [www.whitehouse.gov/omb/circulars](http://www.whitehouse.gov/omb/circulars). If the Scope of Work (by task, if applicable) encompasses research activities which may be funded by one or more sponsors, then allowable project costs may be allocated at the Scope of Work or task level, as appropriate, to any or all of the funding sources. Financial reporting will be at the total-agreement level.

Escalation of labor and EERC recharge center rates is incorporated into the budget when a project's duration extends beyond the current fiscal year. Escalation is calculated by prorating an average annual increase over the anticipated life of the project.

The cost of this project is based on a specific start date indicated at the top of the EERC budget. Any delay in the start of this project may result in a budget increase. Budget category descriptions presented below are for informational purposes; some categories may not appear in the budget.

**Salaries:** The EERC employs administrative staff to provide required services for various direct and indirect support functions. Salary estimates are based on the scope of work and prior experience on projects of similar scope. The labor rate used for specifically identified personnel is the current hourly rate for that individual. The labor category rate is the current average rate of a personnel group with a similar job description. Salary costs incurred are based on direct hourly effort on the project. Faculty who work on this project will be paid an amount over their normal base salary, creating an overload which is subject to limitation in accordance with university policy. Costs for general support services such as contracts and intellectual property, accounting, human resources, purchasing, shipping/receiving, and clerical support of these functions are included in the EERC facilities and administrative cost rate.

**Fringe Benefits:** Fringe benefits consist of two components which are budgeted as a percentage of direct labor. The first component is a fixed percentage anticipated to be approved for use beginning July 1, 2008, by the UND cognizant audit agency, the Department of Health and Human Services. This portion of the rate covers vacation, holiday, and sick leave (VSL) and is applied to direct labor for permanent staff eligible for VSL benefits. Only the actual approved rate will be charged to the project. The second component is estimated on the basis of historical data and is charged as actual expenses for items such as health, life, and unemployment insurance; social security; worker's compensation; and UND retirement contributions.

**Travel:** Travel is estimated on the basis of UND travel policies which can be found at [www.und.edu/dept/accounts/policiesandprocedures.html](http://www.und.edu/dept/accounts/policiesandprocedures.html). Estimates include General Services Administration

(GSA) daily meal rates. Travel may include site visits, field work, meetings, and conference participation as indicated by the scope of work and/or budget.

**Equipment:** If equipment is budgeted, it is discussed in the text of the proposal and/or identified more specifically in the accompanying budget detail.

**Supplies – Professional, Information Technology, and Miscellaneous:** Supply and material estimates are based on prior experience and may include chemicals, gases, glassware, nuts, bolts, and piping. Computer supplies may include data storage, paper, memory, software, and toner cartridges. Maps, sample containers, minor equipment, signage, and safety supplies may be necessary as well as other organizational materials such as subscriptions, books, and reference materials. General purpose office supplies (pencils, pens, paper clips, staples, Post-it notes, etc.) are included in the facilities and administrative cost.

**Subcontracts/Subrecipients:** Not applicable.

**Professional Fees/Services (consultants):** Not applicable.

### **Other Direct Costs**

**Communications and Postage:** Telephone, cell phone, and fax line charges are generally included in the facilities and administrative cost. Direct project costs may include line charges at remote locations, long-distance telephone, postage, and other data or document transportation costs.

**Printing and Duplicating:** Photocopy estimates are based on prior experience with similar projects. Page rates for various photocopiers are established annually by the university's duplicating center.

**Food:** Food expenditures for project meetings, workshops, and conferences where the primary purpose is dissemination of technical information may include costs of food, some of which may exceed the institutional limit.

**Professional Development:** Fees are for memberships in technical areas directly related to work on this project. Technical journals and newsletters received as a result of a membership are used throughout development and execution of the project by the research team.

**Fees and Services – EERC Recharge Centers, Outside Labs, Freight:** EERC recharge center rates for laboratory, analytical, graphics, and shop/operation fees are anticipated to be approved for use beginning July 1, 2008. Only the actual approved rates will be charged to the project.

Laboratory and analytical fees are charged on a per sample, hourly, or daily rate, depending on the analytical services performed. Additionally, laboratory analyses may be performed outside the university when necessary.

Graphics fees are based on an established per hour rate for production of such items as report figures, posters, and/or PowerPoint images for presentations, maps, schematics, Web site design, professional brochures, and photographs.

Shop and operation fees are for expenses directly associated with the operation of the pilot plant facility. These fees cover such items as training, personal safety (protective eyeglasses, boots, gloves), and physicals for pilot plant and shop personnel.

Freight expenditures generally occur for outgoing items and field sample shipments.

**Facilities and Administrative Cost:** Facilities and administrative cost is calculated on modified total direct costs (MTDC). MTDC is defined as total direct costs less individual items of equipment in excess of \$5000 and subawards in excess of the first \$25,000 for each award.

April 30, 2008

Ms. Karlene Fine  
Executive Director  
North Dakota Industrial Commission  
600 East Boulevard Avenue  
State Capitol, 14th Floor  
Bismarck, ND 58505-0840

Subject: Cost Share for North Dakota Renewable Energy Program

This is to verify that a current project with the U.S. Army Corp of Engineers Engineer Research and Development Center, Construction Engineering Research Laboratory (ERDC-CERL) will allocate \$50,000 as cost share for a project being proposed to North Dakota's Renewable Energy Program (REP). As overall project manager for the current project entitled "Production of JP-8-Based Hydrogen and Advanced Tactical Fuels for the U.S. Military" (Cooperative Agreement No. W9132T-05-2-0024), I give approval for this cost share. The cost share is for a project being proposed and submitted to the REP authored by Debra Pflughoeft-Hassett, a Senior Research Advisor at the Energy & Environmental Research Center. Her project is entitled "Development of Economically Sustainable Distributed Power from Biomass Gasification for North Dakota." The project involves utilizing an existing biomass gasification system currently set up as a demonstration system at an industrial site in Grand Forks as a training and educational facility for interested North Dakota industrial clients. The project is a perfect fit for the REP and aids our military project in determining the real potential for biomass distributed energy systems on military bases.

If you have any further questions or concerns, please contact me by phone at (701) 777-5123 or by e-mail at [czygarlicke@undeerc.org](mailto:czygarlicke@undeerc.org).

Kind Regards,



Christopher J. Zygarlicke  
Deputy Associate Director for Research

CJZ/cs