March 1, 2004

Ms. Karlene Fine
Executive Director
North Dakota Industrial Commission
State Capitol, 14th Floor
600 East Boulevard Avenue, Department 405
Bismarck, ND 58505-0840

Dear Ms. Fine:

Subject: EERC Proposal No. 2004-0184, "Improving Electrical Energy Efficiency in E&P: An EERC-Sponsored Regional Workshop"

Enclosed please find 15 copies of the subject proposal in addition to the $100 application fee. A PDF version of the proposal has also been e-mailed to you. The Energy & Environmental Research Center (EERC) recognizes the opportunity to facilitate information dissemination related to recent technology developments in the area of improving energy efficiency in oil and gas exploration and production (E&P) operations to reduce electrical costs and improve hydrocarbon production in North Dakota. The EERC looks forward to the opportunity to work with the North Dakota Industrial Commission in the development of a workshop aimed at reducing electrical costs and improving ultimate recovery in North Dakota's oil and gas fields.

If you have any questions or comments, please contact me by phone at (701) 777-5157 or e-mail at jharju@undeerc.org.

Sincerely,

John A. Harju
Associate Director for Research

JAH/drh

Enclosures

c/enc: Harvey Ness, Lignite Research Council

IMPROVING ELECTRICAL ENERGY EFFICIENCY IN E&P: AN EERC-SPONSORED REGIONAL WORKSHOP

EERC Proposal No. 2004-0184

Submitted to:

Ms. Karlene Fine

North Dakota Industrial Commission
State Capitol, 14th Floor
600 East Boulevard Avenue, Department 405
Bismarck, ND 58505-0840

North Dakota Industrial Commission Oil and Gas Research Fund

Amount of Request: $5000

Submitted by:

John A. Harju
Thea E. Reilkoff

Energy & Environmental Research Center
University of North Dakota
PO Box 9018
Grand Forks, ND 58202-9018

John A. Harju, Project Manager

Dr. William D. Gosnold Jr., Interim Director
Office of Research and Program Development

March 2004

TABLE OF CONTENTS

IMPROVING ELECTRICAL ENERGY EFFICIENCY IN E&P: AN EERC-SPONSORED REGIONAL WORKSHOP

ABSTRACT

The need for oil and gas operators to effectively optimize production of all wells in a cost-effective manner is always present, yet not always achievable with the tools and practices used today. Recent technology advancements and techniques for improving operational efficiency show great promise to positively affect day-to-day exploration and production (E&P) operations. Several opportunities exist to improve energy efficiency in North Dakota (ND) oil and gas E&P operations including 1) making greater use of energy-efficient equipment; 2) optimizing systems and procedures through a whole-systems approach, minimizing energy use across an entire operation versus attempting to maximize efficiency at every point; and 3) adopting new technologies and processes that decrease the energy consumed in production. In an effort to assist ND oil and gas producers in the identification of opportunities for reducing electrical power costs while optimizing ultimate recovery, the Energy & Environmental Research Center (EERC), in collaboration with the North Dakota Department of Commerce Division of Community Services, proposes to conduct a 1-day informational workshop highlighting recent industry advances in improving electrical energy efficiency in E&P operations.

The goal of the proposed workshop will be to assist ND oil and gas producers in decision making, planning, and implementation of technologies that optimize oil and gas production through improvements in operational electrical energy efficiency.

The proposed workshop will target issues pertinent to E&P operations in ND oil and natural gas fields. The EERC will seek qualified individuals experienced in E&P operations, including technology providers, oil and gas producers, and EERC research staff, to effectively communicate opportunities for electrical efficiency improvements in this region.

IMPROVING ELECTRICAL ENERGY EFFICIENCY IN E&P: EERC-SPONSORED REGIONAL WORKSHOP

PROJECT SUMMARY

The Energy & Environmental Research Center (EERC) proposes to conduct a 1-day informational workshop highlighting recent exploration and production (E&P) industry advancements in improving electrical energy efficiency. Through information dissemination, the workshop will seek to assist in decision making, planning, and implementation of technologies that reduce operational costs while optimizing ultimate recovery in North Dakota (ND) oil and gas production operations.

The proposed workshop will be tailored to personnel responsible for E&P operations in ND oil and natural gas fields. The EERC will seek qualified individuals experienced in E&P operations, including technology providers, oil and gas producers, and EERC research staff, to effectively communicate opportunities for efficiency improvements in this region.

PROJECT DESCRIPTION

Recent advances in the arena of high-efficiency motors, self-generation of electricity, metering techniques, and remote monitoring technologies show great promise to positively affect the efficiency of day-to-day E&P operations.

Several opportunities exist to improve energy efficiency in ND oil and gas E&P operations, including 1) making greater use of energy-efficient equipment, 2) optimizing systems and procedures by minimizing energy use across an entire operation versus attempting to maximize efficiency at every point, and 3) adopting new technologies and processes that decrease the energy needed for production. The proposed workshop will address such

opportunities through detailed presentation and discussion of relevant topics. Suggested discussion topics include:

1. Improved artificial lift technology
2. Timers, pump-off control, and effective metering techniques
3. Self-generated power
4. Field automation
5. Total well management

The EERC recognizes the North Dakota Industrial Commission's (NDIC's) knowledge and expertise as an authority in ND oil and gas E&P operations and will welcome suggestions and participation in development of workshop content.

Numerous studies have been conducted identifying methods for optimizing production and improving electrical energy efficiency in oil and gas operations throughout the United States. The following sections briefly highlight industry advancements in the five suggested topic areas.

Improved Artificial Lift Technology

The modern philosophy in effectively utilizing artificial lift technologies stresses optimization. Through optimization of pump or lift system technology, operators can realize increased performance and production and reduced operational costs and incidences of mechanical failure. Because of time limitations, artificial lift operations are not always adequately maintained, let alone optimized for maximum efficiency. Review of artificial lift basics and advancements, including several types of artificial lift systems available (i.e., beam, electric submersible, progressing-cavity, and long-stroke pumps), and optimum application environment is an important step in identifying opportunities for increasing production and lowering operating costs. Electric power can account for 10%–40% of lifting costs (*Electrical*

Power, 1998 and 1999). Through technology optimization and implementation of additional methods discussed below, this cost may be reduced substantially.

Timers, Pump-Off Control, and Metering Techniques

Wells that operate 24 hours a day and have a pump capacity in excess of the well's producing rate may benefit from the utilization of timer control systems. By reducing operating time, timer control system utilization can result in lowered maintenance and electrical costs. Two general types of timer control systems are available: 1) manually set on/off timers and 2) automatic pump-off controller systems. An electrical manually set on/off timer can be used to control when the pump motor operates, while an automatic pump-off controller device can monitor a parameter that relates to well liquid levels and shut down the pumping unit motor when partial pump fillage or liquid no-flow is detected. Both pump-off controllers and preset timers have advantages and disadvantages and must be evaluated with respect to well field operating conditions. The primary disadvantage of pump-off controller systems is the increased cost per well in addition to a requirement for remote monitoring or increased field monitoring of well performance. While pump-off controller devices may provide substantial savings in appropriate wells, comparisons of operating and electrical costs versus the capital investment of installation should be considered. Preset timers offer the advantage of being simple to operate and inexpensive; however, they require that the operator correctly set the timer to operate the pumping system for the optimum amount of time. Another potential disadvantage of the preset timer is that the on/off cycle intervals cannot be automatically adjusted to account for changes in pump condition or the well's maximum potential flow rate. Regardless of apparent shortcomings, preset timers and pump-off controllers can offer significant savings in well field operation. According to a 2001 case study, CamWest, Inc., in its operations near Lander, Wyoming,

effectively installed Web-based pump-off controllers to better manage oil production activities in remote locations. Technology implementation successfully reduced electrical costs by approximately 15%, in addition to added value expected in production optimization, reduced well servicing costs, and quicker response times (Torr et al., 2000).

In addition to the utilization of timer control, advantages can be realized in metering techniques and power usage tracking. According to Chris Hall of Drilling & Production Co., "Operator experience confirms that low-tech, low-cost actions can reduce electrical power costs by as much as 30% or more, when applying simple, good business management practices and monitoring their operations" (Hall, 2000). Hall's study outlines a practical way of tracking and managing power usage and costs and identifying opportunities for electrical savings such as utilization of off-peak pumping. A case study conducted by Equinox Oil Company in the South Albion Field in Illinois has found that by installing timers and taking advantage of rates for pumping during off-peak hours, electrical consumption was reduced by 25%, decreasing power costs by $2000 a month, without an appreciable change in production (*Best Practices*, 1999; Coston et al., 1999).

Self-Generated Power

Utilization of distributed energy resources (DER) provides another option for reducing operational costs, provided power costs are not below 2 to 3 cents/kWh (*Best Practices*, 1999). The potential cost savings to be gained from electrical self-generation are site-specific, affected by the utility's rates, demand charges, the cost of fuel, and the cost of equipment. Self-generation can be particularly attractive to sites that have flared or low-cost gas available for fuel. DER can be isolated or connected to the main power grid. For on-site power consumption, DER may offer several benefits including reduction in production costs of marginal wells and reduced emissions

through avoidance of gas flaring or venting. DER may also offer pricing leverage to use with the electricity supplier.

Several types of DER technologies are currently available for E&P operations, including reciprocating engines, microturbines, and turbines. The EERC is currently conducting a demonstration project in collaboration with Amerada-Hess, the U.S. Department of Energy (DOE), the North Dakota Division of Community Services (DCS), and Interstate Power Systems (a distributor for Capstone Turbine Corporation) to determine the economic viability of distributed generation from microturbines fueled with well field sour gas (Schmidt, 2003). Capstone Turbine Corporation is a relatively new company that produces 30- and 60-kW turbine power plants designed for combined heat and power applications. The EERC expects savings of $15,680 from a single 30-kW microturbine over 8000 hours and simple payback of 2.5 years; the installation cost is approximately $40,000, and the expected operational lifetime is 40,000 hours or 5 years. Preliminary calculations indicate the potential for a 76% reduction in NO_x, CO, and potentially volatile organic compound emissions.

Field Automation

Through the utilization of field automation systems, production costs can be reduced while total production is maintained or increased. Advanced computer and communication technology can increase productivity, while optimizing operations through reducing both the time required for manual reporting and the errors inherent with manual data collection. Field automation systems typically provide four primary functions: 1) basic status, 2) alarming, 3) trending, and 4) control. Trending software allows a comparison to be made between current readings/performance and historical data, thereby allowing operators to quickly identify and

mitigate potential problems before they result in lost production due to equipment failure and other controllable setbacks.

Total Well Management

Total well management seeks to reduce operating costs, increase oil production, and increase net income through an integrated analysis of the pumping unit as a complete system including performance and interaction of all the elements (the prime mover, surface equipment, well bore equipment, down-hole pump, down-hole gas separator, and the reservoir). The total well management procedure is greatly facilitated through the implementation of a fully integrated portable instrument that includes all necessary sensors, precision analog to digital electronics, and computer hardware and software components to allow for immediate analysis of well performance on-site. Podio et al. in Total Well Management II outline a series of well performance questions that an operator should be able to answer in order to efficiently produce a well (2001). Specifically, the operator must know 1) the producing bottom-hole pressure is low compared to the static bottom hole pressure so that maximum production is being obtained, 2) whether the down-hole gas separator is efficient or not and how to correct a problem of inefficiency, 3) whether a pumping unit is correctly balanced, and 4) whether rods are overloaded or not. A workshop summary provided through the Petroleum Technology Transfer Council (PTTC) advises that motors be checked for general condition, noise, vibration, lubrication, and size and that when replacement is required, efficiency should be given consideration in addition to cost (*Artificial Lift*, 2000). This is generally true for most components as inefficiencies can result in premature equipment failure and increased power costs.

STANDARDS OF SUCCESS

The overall success of this project will be based on the identification of opportunities for increasing electrical energy efficiency in ND oil and gas E&P operations. The proposed workshop will seek to assist ND operators in effectively identifying opportunities for lowering operating costs while maintaining or increasing overall production. The success of the workshop will be measured through follow-up communication with participants and presenters. The EERC will serve as a facilitator, when appropriate, to foster relationships between technology and service providers and workshop participants to encourage future demonstrations and deployments.

BACKGROUND

PTTC as well as numerous technology and service providers have sponsored a wide range of workshops and training sessions aimed at addressing the topics outlined in this proposal. The EERC will draw from such experience and seek participation from identified experts in strategies for improving energy efficiency in E&P operations. The EERC also recognizes the value of NDIC and the North Dakota Petroleum Council's (NDPC's) knowledge and expertise in ND oil and gas E&P operations and will welcome the opportunity to work with both organizations to ensure that information most advantageous to ND producers is conveyed. The EERC has many years of experience in conducting successful workshops and conferences in numerous areas of energy and environmental research. The EERC has a strong history of working with commercial and government partners to effectively turn research interests into demonstration, deployment, and commercialization ventures.

QUALIFICATIONS

The EERC was established in 1949 as a federal research facility under the U.S. Bureau of Mines and later became the lead laboratory for low-rank coals under DOE. The center was defederalized in 1983 and became a business unit of the University of North Dakota. The EERC currently has an annual budget of $20 million, covering 241 contracts, three-quarters of which are private-sector clients. In the last 15 years, the EERC has worked with over 750 clients in all 50 states and in 47 countries. The EERC's multidisciplinary staff of more than 260 has maintained its leading role in coal research and has expanded its expertise and partnerships in a broad spectrum of energy and environmental programs. The EERC has successfully completed projects involving geologic characterization of subsurface resources, experimental design, analytical methods development, groundwater quality, biomass-based energy, advanced power systems, atmospheric emission controls, reclamation of disturbed lands, disposal and value-added waste management, disposal site characterization, site remediation for oil and gas, cleanup of the federal weapons complex and industry sites, and training activities from local to international scope.

Key EERC personnel responsible for proposed workshop development include Mr. John Harju, Ms. Thea Reilkoff, and Mr. Darren Schmidt. Mr. Harju is an Associate Director for Research at the EERC and will serve as Project Manager for the proposed workshop. Mr. Harju's responsibilities at the EERC include developing and administering programs involving resource characterization; water and waste management; contamination cleanup; and building industry–government–academic teams to carry out research, development, demonstration, and commercialization of products and technologies. Before joining the EERC, Mr. Harju served as Vice President of Crystal Solutions, LLC, a firm involved in commercial E&P produced water

management, regulatory permitting and compliance, and environmental impact monitoring and analysis. He also worked for Gas Research Institute (now Gas Technology Institute) in the capacity of Principal Scientist in Produced Water Management and Program Team Leader for Soil, Water, and Waste.

Ms. Thea Reilkoff will serve as the Project Coordinator. Ms. Reilkoff is a Research Engineer at the EERC with a master's degree in environmental engineering. She has several years of experience in technology evaluation for cleanup and closure activities within the DOE nuclear weapons complex and is currently working with the Plains CO_2 Reduction Partnership to develop options for CO_2 sequestration, including enhanced oil recovery, in the Great Plains region.

Mr. Darren Schmidt will provide technical assistance on workshop development and serve as a workshop presenter in the area of DER. Mr. Schmidt is a Research Manager at the EERC and a registered Professional Engineer in ND. Prior to his position at the EERC, he served as a Mechanical Engineer and Project Manager at the Research Triangle Institute. Mr. Schmidt's principal areas of interest and expertise include biomass power systems, energy efficiency, and fossil fuel research.

VALUE TO NORTH DAKOTA

According to NDIC oil and gas statistics, the state's oil production dipped slightly in 2003 for the sixth consecutive year (NDIC, 2003). The need for oil and gas operators to effectively optimize production of all wells in a cost-effective manner is always present. This project will seek to assist oil and gas producers in decision making, planning, and implementation of technologies that reduce operational costs and stimulate development of strategies for increased

production in ND through reduction of electric energy demand. The EERC believes that through the implementation of strategies and technologies for achieving energy efficiency, increases in total production can be attained. Such improvements in production will ultimately lead to higher oil tax revenues benefiting ND counties, schools, and cities.

MANAGEMENT

The EERC will work with NDIC and DCS to ensure the goals set and workshop content are appropriate for our target audience. The EERC will also seek involvement from NDPC and PTTC. The EERC recognizes the strong experience in education and training of these organizations and will welcome their input and assistance. The EERC will serve as the project organizer and, where appropriate, as a facilitator for future demonstration and deployment ventures.

TIMETABLE

DCS is committed to providing substantial funding for the proposed workshop with the provision that the event must occur prior to June 30, 2004. In recognizing the value of working with current industry meeting schedules, the EERC is investigating the possibility of holding the workshop on May 2, 2004, in conjunction with the Twelfth Annual Williston Basin Horizontal Well & Petroleum Conference in Minot, North Dakota. The EERC is working with the North Dakota Geological Survey to explore this option in an effort to effectively coordinate the two events. Should this option be determined disadvantageous, the EERC will consider alternative dates and venues complying with the June 30 deadline.

BUDGET AND MATCHING FUNDS

A detailed project budget is included in Appendix D. The total anticipated cost for the proposed project is $25,767, which includes up to $25,000 from DCS and this request of $5000 from NDIC. Food will be provided in conjunction with the workshop, the cost of which may exceed institutional limits. The EERC recognizes NDIC's knowledge and expertise as an authority in ND oil and gas E&P operations and, therefore, cannot overstate the importance of obtaining financial support from NDIC as it would firmly signify the level of commitment from the organization. If NDIC is unable to support this project, the EERC is prepared to complete the proposed project with only DCS support without compromising project quality.

TAX LIABILITY

The EERC is part of the University of North Dakota and as such is not a taxable entity.

CONFIDENTIAL INFORMATION

This project has no confidential information.

PATENTS AND RIGHTS TO TECHNICAL DATA

No patentable material is expected to be generated by this project.

APPENDIX A

REFERENCES

APPENDIX A – REFERENCES

Artificial Lift Basics and Advancements Including Remote Monitoring and Reducing Electrical Consumption. Workshop sponsored by PTTC's North Midcontinent Region, Wichita, KS, Sept 12, 2000.

Best Practices for Improving Economic Margins. Workshops developed by PTTC's Midwest, North Midcontinent, and Rocky Mountain regions, March 1999.

Coston, D.; Dicus, B. How to Reduce Electrical Power Costs without Sacrificing Production Rate, Petroleum Technology Digest supplement to *WorldOil*, Sept 1999, www.worldoil.com.

Distributed Energy Resources in the Oil Patch. Workshop sponsored by PTTC's Central Gulf and Texas Regions, Houston, TX, May 15, 2000.

Electrical Power Cost Reduction Methods in Oil and Gas Fields. Workshop sponsored by PTTC's Central Gulf Region, Lafayette, LA, March 24, 1999.

Electrical Power Cost Reduction Methods in Oil and Gas Fields. Workshop sponsored by PTTC's Central Gulf Region, Shreveport, LA, Oct 13, 1998.

Hall, J.C. How to Cut Electrical Power Costs by 30% with Little or No Investment. Petroleum Technology Digest supplement to *WorldOil*, May 2000, www.worldoil.com.

NDIC Oil & Gas Division. 2003 North Dakota Drilling and Production Statistics. www.oilgas.nd.gov/stats/statistics.html.

Podio, A.L.; McCoy, J.N.; Rowlan, L.; Drake, B. Total Well Management II. Presented at the SPE Production and Operations Symposium, Oklahoma City, OK, March 24–27, 2001.

Torr, D.; Mooney, D. Web-Based Pump-Off Controller Reduces Electricity, Petroleum Technology Digest supplement to *WorldOil*, Sept 2001, www.worldoil.com.

Schmidt, D. Power Production from Sour Gas. EERC proposal submitted to Amerada Hess Corporation, April 2003.

APPENDIX B

LETTER OF SUPPORT

North Dakota
Department of Commerce

Community Services

Economic
Development & Finance

Tourism

Workforce Development

Century Center

1600 E. Century Ave

Suite 2

PO Box 2057

Bismarck, ND 58502-2057

Phone 701-328-5300

Fax 701 328-5320

www.ndcommerce.com

February 25, 2004

Mr. John Harju
Associate Director for Research
Energy & Environmental Research Center
PO Box 9018
Grand Forks, ND 58202-9018

Dear Mr. Harju:

I am pleased to offer this letter of support for the EERC proposed workshop intended to identify opportunities for improving energy efficiency in the oil and gas industry exploration and production operations in the state.

The North Dakota Department of Commerce, Division of Community Services (DCS) State Energy Program is committed to advancing new, cost-effective applications and technologies that reduce energy consumption and contribute to a cleaner environment. The DCS State Energy Program fully recognizes the value of this activity, and is committed to providing up to $25,000 in support of it, with the provision that the event must occur prior to June 30, 2004.

The DCS has had a successful working relationship with the EERC, and is confident that your long-standing expertise in a range of energy and environmental issues, in addition to your proven ability in conference development, will ensure a successful workshop.

Sincerely,

Joe Murphy, Program Administrator
Division of Community Services

pa

APPENDIX C

RESUMES OF KEY PERSONNEL

JOHN A. HARJU
Associate Director for Research
Energy & Environmental Research Center (EERC)
University of North Dakota (UND)
PO Box 9018, Grand Forks, North Dakota 58202-9018 USA
Phone (701) 777-5000 Fax (701) 777-5181
E-Mail: jharju@undeerc.org

Principal Areas of Expertise

Mr. Harju's principal areas of interest and expertise include waste management, environmental geochemistry, technology development, hydrology, and analytical chemistry, especially as applied to the upstream oil and gas industry.

Qualifications

B.S., Geology, University of North Dakota.
Postgraduate course work in Management, Economics, Marketing, Education, Climatology, Weathering and Soils, Geochemistry, Geochemical Modeling, Hydrogeochemistry, Hydrogeology, Contaminant Hydrogeology, Advanced Physical Hydrogeology, and Geostatistics.

Professional Experience

2003 – Associate Director for Research, EERC, UND. Mr. Harju's responsibilities include developing and administering environmental programs involving water management and contamination cleanup and building industry–government–academic teams to carry out research, development, demonstration, and commercialization of environmental products and technologies.

2002 – 2003 Senior Research Advisor, EERC, UND. Mr. Harju's responsibilities included development, marketing, management, and dissemination of market-oriented research; development of programs focused on the environmental and health effects of power and natural resource production, contaminant cleanup, water management, and analytical techniques; publication and presentation of results; client interactions; and advisor to internal staff.

1999 – 2002 Vice President, Crystal Solutions, LLC, Laramie, Wyoming. Mr. Harju's firm was involved in commercial E&P produced water management, regulatory permitting and compliance, and environmental impact monitoring and analysis.

2000 – 2002 Principal Scientist, Produced Water Management, Gas Research Institute (GRI) (now Gas Technology Institute [GTI]), Chicago, Illinois. Mr. Harju's responsibilities included development and deployment of produced water management technologies and methodologies for cost-effective and environmentally responsible management of oil and gas produced water.

1998 – 2000 Program Team Leader, Soil, Water, and Waste, GRI/GTI, Chicago, Illinois. Mr. Harju's responsibilities included project and program management related to the

development of environmental technologies and informational products related to the North American oil and gas industry; formulation of RFPs, proposal review, and contract formulation; technology transfer activities; and staff and contractor supervision. Mr. Harju served as Manager of the Environmentally Acceptable Endpoints project, a multiyear, $8 MM effort focused on a rigorous determination of appropriate cleanup levels for hydrocarbons and other energy-derived contaminants in soils. He also led GRI/GTI involvement with numerous industry environmental consortia and organizations, including PERF, SPE, AGA, IPEC, and API.

1997 – 1998 Principal Technology Manager, Soil and Water Quality, GRI/GTI, Chicago, Illinois.

1997 Associate Technology Manager, Soil and Water Quality, GRI/GTI, Chicago, Illinois.

1994 – 1996 Senior Research Manager, Oil and Gas Group, EERC, UND. Mr. Harju's responsibilities included the following:

- Program Manager for program to assess the environmental transport and fate of oil- and gas-derived contaminants, focused on mercury and sweetening and dehydration processes.
- Project Manager for field demonstration of innovative produced water treatment technology using freeze crystallization and evaporation at oil and gas industry site.
- Program Manager for environmental transport and fate assessment of MEA and its degradation compounds at Canadian sour gas-processing site.
- Program Manager for demonstration of unique design for oil and gas surface impoundments.
- Director, National Mine Land Reclamation Center – Western Region.
- Co-Principal Investigator on project exploring feasibility of underground coal gasification in southern Thailand.
- Consultant to International Atomic Energy Agency for program entitled "Solid Wastes and Disposal Methods Associated with Electricity Generation Fuel Chains."

1994 Research Manager, EERC, UND.

1990 – 1994 Hydrogeologist, EERC, UND.

1989 – 1990 Research Specialist, EERC, UND.

1988 – 1989 Laboratory Technician, EERC, UND.

Professional Memberships

- Rocky Mountain Association of Geologists

Publications and Presentations

- Has authored and coauthored numerous publications

THEA E. REILKOFF
Research Engineer
Energy & Environmental Research Center (EERC)
University of North Dakota (UND)
PO Box 9018, Grand Forks, North Dakota 58202-9018 USA
Phone (701) 777-5000 Fax (701) 777-5181
E-Mail: treilkoff@undeerc.org

Principal Areas of Expertise

Geologic carbon sequestration, including enhanced oil recovery; technology identification and evaluation for cleanup and long-term stewardship of the DOE nuclear weapons complex; optimization of energy efficiency in renewable fuel utilization, including energy storage; and contaminant hydrology and groundwater remediation;.

Qualifications

M.S., Environmental Science and Engineering, Oregon Graduate Institute, Beaverton, Oregon, 2000.
B.S., Chemistry, Mayville State University, Mayville, North Dakota, 1997.
Continuing Education, the Princeton Groundwater Pollution and Hydrology Course, Orlando, Florida, July 8–12, 2002.
Continuing Education, Argonne National Laboratory Training Course on Decontamination and Decommissioning of Research Reactors and Other Small Nuclear Facilities, Augusta Georgia, Aug 5–9, 2001.

Professional Experience

2001–Present: Research Engineer, EERC, UND. Primary responsibilities have included identifying opportunities for geologic carbon sequestration, including enhanced oil recovery, in the Great Plains region; optimizing energy efficiency of renewable fuels utilization including energy storage; identifying and evaluating technologies and remediation systems for the cleanup and long-term stewardship of DOE's nuclear weapons complex; and groundwater contaminant hydrology and remediation.

2000: Instructor, Department of Math and Sciences, Mayville State University. Responsibilities included lectures and laboratory instruction in Physical and Natural Sciences.

1997–2000: Graduate Research, Department of Environmental Science and Engineering, Oregon Graduate Institute. Responsibilities included investigating the reduction of organic compounds by electron and enzyme-mediated hydride transfer in anaerobic sediments.

1996: Undergraduate Research Assistant, Department of Chemistry, University of North Dakota. Responsibilities included research in the area of biophysical chemistry, focusing on the simulation of protein–protein interactions in complex formation between cytochrome c and cytrochrome b5.

Professional Memberships

- American Nuclear Society

Relevant Publications

- Jensen, M.D.; Leroux, K.M.B.; Daly, D.J.; Reilkoff, T.E. Evaluation of Pumps and Instrumentation to Support the Fernald Silo Waste Processing Project. Final report prepared for Oak Ridge National Laboratory, 2003.

- Reilkoff, T.E.; Williams, K.D.; Kay, J.P. Infrared Thermography. Final report prepared for U.S. Department of Energy National Energy Technology Laboratory, 2003.

- Reilkoff, T.E.; Hetland (Jensen), M.D.; O'Leary, E.M. Review of Industries and Government Agencies for Technologies Applicable to Deactivation and Decommissioning of Nuclear Weapons Facilities. Final report prepared for U.S. Department of Energy National Energy Technology Laboratory, 2001.

DARREN D. SCHMIDT
Research Manager
Energy & Environmental Research Center (EERC)
University of North Dakota (UND)
PO Box 9018, Grand Forks, North Dakota 58202-9018 USA
Phone (701) 777-5000 Fax (701) 777-5181
E-Mail: dschmidt@undeerc.org

Principal Areas of Expertise

Mr. Schmidt's principal areas of interest and expertise include biomass energy, energy efficiency, cofiring, small power systems, geothermal heat pump systems, production of hydrogen from biomass, biomass gasification, fuel cells, and fossil energy research

Qualifications

B.S., Mechanical Engineering, West Virginia University, 1994
Registered P.E.
Certified Energy Manager

Professional Experience

1998 – Research Manager, EERC, UND. Mr. Schmidt's responsibilities include securing research contracts, managing projects, and performing engineering tasks in the areas of cofiring and biomass power systems, including combustion, fluidized bed, gasification, microturbine, and internal combustion engine generators; energy efficiency; ground-source heat pumps; hydrogen production from biomass; and researching the behavior of biomass in combustion systems relative to ash fouling and trace elements.

1994 – 1998 Mechanical Engineer III, Research Triangle Institute (RTI), Research Triangle Park, North Carolina. Mr. Schmidt's responsibilities included serving as project leader for a $3M Cooperative Agreement with the U.S. Environmental Protection Agency (EPA) to demonstrate electricity production using a 1-MW wood gasification technology. The project involved engineering design, specification, purchase, fabrication, installation, and testing for a wood chip feed system; obtaining a North Carolina air quality permit; development of a computer program to interactively solve thermodynamics for drying; interaction with the EPA client, project subcontractors, and RTI project team; budget tracking and projecting; operation and testing of the power plant facility; preparing an 1-MW Waukesha engine generator set to burn low-Btu wood gas; and completion of technical reports for the EPA project monitor and for RTI management. Other activities at RTI included support of marketing activities and coauthoring publications.

Summer 1993 Internship, EERC, UND. Mr. Schmidt's responsibilities included operation of a pressurized drop-tube furnace to analyze coal ash deposition in large-scale utility boilers. Ash samples were scanned by an electron microscope, and data analysis techniques were used to characterize the coal ash. Other activities involved design

and testing of an experimental coal slurry feed system for the drop-tube furnace and compiling reports on testing procedures and test results.

Summer 1992 Internship, Foster Wheeler Development Corporation, Livingston, New Jersey. Mr. Schmidt's responsibilities included a research project involving testing the first stage of a fluidized-bed coal gasification combined-cycle process. Duties included collecting and logging all process samples during a 2-week test run; analyzing data collected for all previous test runs to establish relationships between the data and the plant-operating conditions; and submitting internal reports to the supervising research professor to state conclusions.

Publications and Presentations

- Has authored and coauthored several publications.

APPENDIX D

BUDGET DETAILS

BUDGET

IMPROVING ELECTRICAL ENERGY EFFICIENCY IN E & P: REGIONAL WORKSHOP
NDIC-OIL AND GAS RESEARCH COUNCIL
EERC PROPOSAL #2004-0184

CATEGORY		TOTAL HRS	TOTAL $COST
TOTAL DIRECT LABOR		406	$ 8,482
FRINGE BENEFITS - % OF DIRECT LABOR	53%		$ 4,495
TOTAL LABOR			$ 12,977
OTHER DIRECT COSTS			
TRAVEL			$ 3,500
COMMUNICATION - PHONES & POSTAGE			$ 1,140
RENTS & LEASES			$ 600
OFFICE (PROJECT SPECIFIC SUPPLIES)			$ 2,005
SUPPLIES			$ 500
GENERAL (FREIGHT, FOOD, MEMBERSHIPS, ETC.)			$ 2,525
FEES			$ 2,520
TOTAL OTHER DIRECT COST			$ 12,790
TOTAL DIRECT COST			$ 25,767
FACILITIES & ADMIN. RATE - % OF MTDC	56%		$ 14,430
TOTAL ESTIMATED COST			$ 40,197
WAIVED F & A			$ 14,430
TOTAL FUNDS TO BE REQUESTED			$ 25,767

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, or other agreements. Although the EERC is not affiliated with any one academic department, university academic faculty may participate in a project, depending on the scope of work and expertise required to perform the project.

The proposed work will be done on a cost-reimbursable basis. The distribution of costs between budget categories (labor, travel, supplies, equipment, subcontracts) is for planning purposes only. The principal investigator may, as dictated by the needs of the work, reallocate the budget among approved items or use the funds for other items directly related to the project, subject only to staying within the total dollars authorized for the overall program. The budget prepared for this proposal is based on a specific start date; this start date is indicated at the top of the EERC budget or identified in the body of the proposal. Please be aware that any delay in the start of this project may result in an increase in the budget.

Salaries and Fringe Benefits

As an interdisciplinary, multiprogram, and multiproject research center, the EERC employs an administrative staff to provide required services for various direct and indirect support functions. Direct project salary estimates are based on the scope of work and prior experience on projects of similar scope. Technical and administrative salary charges are based on direct hourly effort on the project. 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. For faculty, if the effort occurs during the academic year and crosses departmental lines, the salary will be in addition to the normal base salary. University policy allows faculty who perform work in addition to their academic contract to receive no more than 20% over the base salary. Costs for general support services such as grants and contracts administration, accounting, personnel, and purchasing and receiving, as well as clerical support of these functions, are included in the EERC facilities and administrative cost rate.

Fringe benefits are estimated on the basis of historical data. The fringe benefits actually charged consist of two components. The first component covers average vacation, holiday, and sick leave (VSL) for the EERC. This component is approved by the UND cognizant audit agency and charged as a percentage of direct labor for permanent staff employees eligible for VSL benefits. The second component covers actual expenses for items such as health, life, and unemployment insurance; social security matching; worker's compensation; and UND retirement contributions.

Travel

Travel is estimated on the basis of UND travel policies which can be found at: http://www.und.edu/dept/accounts/employeetravel.html. Estimates include General Services Administration (GSA) daily meal rates. Travel includes scheduled meetings and conference participation as indicated in the scope of work.

Communications (phones and postage)

Monthly telephone services and fax telephone lines are generally included in the facilities and administrative cost. Direct project cost includes line charges at remote locations, long-distance telephone, including fax-related long-distance calls; postage for regular, air, and express mail; and other data or document transportation costs.

Office (project-specific supplies)

General purpose office supplies (pencils, pens, paper clips, staples, Post-it notes, etc.) are provided through a central storeroom at no cost to individual projects. Budgeted project office supplies include items specifically related to the project; this includes duplicating and printing.

Data Processing

Data processing includes items such as site licenses and computer software.

Supplies

Supplies in this category include scientific supply items such as chemicals, gases, glassware, and/or other project items such as nuts, bolts, and piping necessary for pilot plant operations. Other items also included are supplies such as computer disks, computer paper, memory chips, toner cartridges, maps, and other organizational materials required to complete the project.

Instructional/Research

This category includes subscriptions, books, and reference materials necessary to the project.

Fees

Laboratory, analytical, graphics, and shop/operation fees are established and approved at the beginning of the university's fiscal year.

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 overall graphics production such as report figures, posters for poster sessions, standard word or table slides, simple maps, schematic slides, desktop publishing, photographs, and printing or copying.

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

General

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

Membership fees (if included) 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 as well as by the research team directly involved in project activity.

General 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), transportation, rental of facilities, and other items incidental to such meetings or conferences.

Facilities and Administrative Cost

The facilities and administrative rate (indirect cost rate) included in this proposal is the rate that became effective July 1, 2002. 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 subcontracts/subgrants in excess of the first $25,000 for each award.