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December 31, 2014

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

Dear Ms. Fine:

Subject: EERC Proposal No. 2015-0102 Entitled "Catalytic Alcohol Condensation to Higher Alcohols"

The Energy & Environmental Research Center (EERC) of the University of North Dakota is pleased to submit an original and one copy of the subject proposal. Also enclosed is the $100 application fee. The EERC is committed to completing the project as described in the proposal if the Commission makes the requested grant.

If you have any questions, please contact me by telephone at (701) 777-5243 or by e-mail at bfolkedahl@undeerc.org.

Sincerely,

Bruce C. Folkedahl
Research Manager

Approved by:

Thomas A. Erickson, Director
Energy & Environmental Research Center

BCF/kal

Enclosures

Renewable Energy Program

North Dakota Industrial Commission

Application

Project Title: Catalytic Alcohol Condensation to Higher Alcohols

Applicant: Energy & Environmental Research Center, University of North Dakota

Principal Investigator: Bruce C. Folkedahl

Date of Application: December 31, 2014

Amount of Request: $250,000

Total Amount of Proposed Project: $500,000

Duration of Project: 12 months

Point of Contact (POC): Bruce C. Folkedahl

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ABSTRACT

Objective: Further development and optimization of the Energy & Environmental Research Center (EERC)-developed catalytic alcohol condensation (CAC) process, which can be used to convert ethanol to normal butanol and other high-value alcohols. The EERC is targeting development of the CAC process to a performance level that would ensure its commercial viability when integrated with operations at a commercial ethanol plant. Along with catalyst and process optimization, a key proposed project objective is to generate the data needed to enable 1) development of a preliminary design for a CAC process as a unit operation integrated on the back end of a commercial ethanol plant and 2) assessment of CAC process commercial viability.

Expected Results: It is anticipated that at the end of this project, the EERC will have 1) optimized the catalyst and its operational process conditions to produce an economically viable stream of high-value products from ethanol, including butanol; 2) demonstrated at the pilot scale at the EERC the overall process, including distillation/separation of products and recycle of unreacted materials; and 3) developed a preliminary design of a skid-mounted system for deployment at an existing ethanol facility in a second phase of the project.

Duration: 12 months

Total Project Cost: Total project cost is $500,000 of which $250,000 is being requested from the North Dakota Renewable Energy Council as match to $250,000 from commercial partners split as $120,000 from National Corn Growers Association and $130,000 from Hankinson Renewable Energy.

Participants: EERC, Guardian Energy, Hankinson Renewable Energy LLC, and the National Corn Growers Association.

PROJECT DESCRIPTION

Objectives:

The overall goal of the proposed project is to optimize a technology that will enable North Dakota ethanol producers to diversify and produce new products for new markets, thereby expanding the renewable energy industry in North Dakota and providing new jobs for the state. This will be accomplished through the proposed optimization of the Energy & Environmental Research Center (EERC)-developed catalytic alcohol condensation (CAC) process, which can be used to convert ethanol to normal butanol and other high-value alcohols. The EERC is targeting development of the CAC process to a performance level that would ensure its commercial viability when integrated with operations at a commercial ethanol plant. Along with process optimization, a key proposed project objective is to generate the data needed to enable 1) development of a preliminary design for a CAC process as a unit operation integrated on the back end of a commercial ethanol plant and 2) assessment of CAC process commercial viability. It is anticipated that a commercially viable CAC process would include:

- Online separation of butanol (via distillation or other higher-efficiency separation method) from unconverted and/or partially converted reactants.
- The ability to sustain sufficient catalyst activity to maintain desired conversion efficiency for at least 24 hours of operation.
- The ability to effect in-bed catalyst regeneration to initial activity level through a simple, inexpensive thermal treatment, which would enable process commercialization via a "three-catalyst-bed" strategy comprising—at any given time—one operating bed, another bed ready for operation, and a third bed undergoing regeneration (see Figure 1).

Methodology:

In addition to catalyst optimization, the proposed project would focus on overall process optimization via adjustment of temperature, pressure, space velocity, and recycle rate in order to achieve the proposed

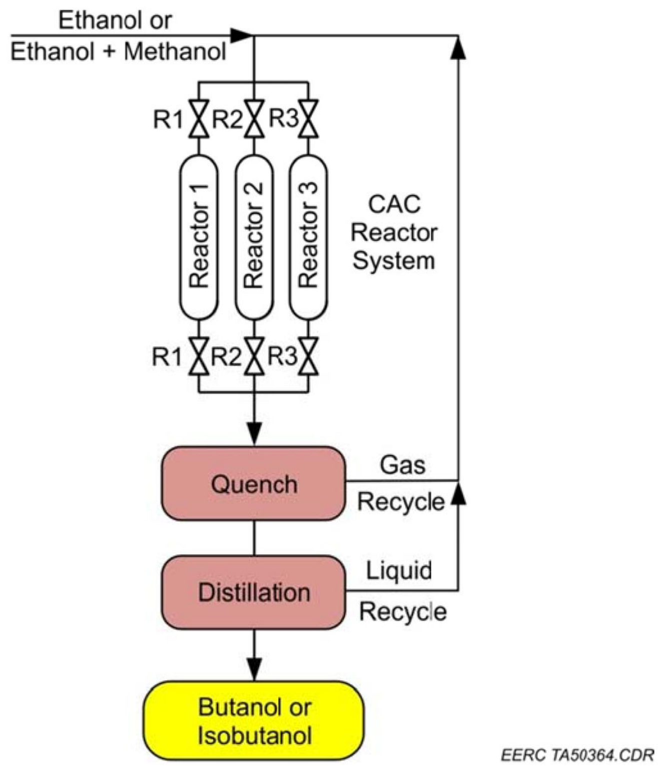

Figure 1. CAC process overview.

targeted performance level. The EERC proposes to achieve these objectives through the following five tasks:

- Task 1 – CAC process optimization (including catalyst optimization) based on product yield and catalyst durability/lifetime, validation of catalyst "regenerability," and establishment of catalyst regeneration protocol.
- Task 2 – Pilot-scale demonstration of a complete CAC process including product recovery and recycle of unreacted feedstocks and process intermediates.
- Task 3 – Preliminary CAC process economic viability assessment.
- Task 4 – Preliminary design of a CAC process demonstration system to be deployed at a commercial ethanol plant.
- Task 5 – Development of a funding strategy for process demonstration system deployment.

Anticipated Results:

It is anticipated that at the end of this project, the EERC will have 1) optimized the catalyst and its operational process conditions to produce an economically viable stream of high-value products from ethanol, including butanol; 2) demonstrated at the pilot scale at the EERC the overall process, including distillation/separation of products and recycle of unreacted materials; and 3) developed a preliminary design of a skid-mounted system for deployment at an existing ethanol facility in a second phase of the project.

Facilities:

EERC laboratory, pilot plant, and office space comprises over 250,000 square feet dedicated to energy and environmental research, development, demonstration, and commercialization. The EERC maintains a wide range of laboratories and equipment for chemical process development and analysis and characterization of solid, liquid, and gaseous reactants and products. These highly sophisticated and diverse tools are transportable between research programs. Specific equipment to be used in this proposed project includes the EERC distillation unit, process chemistry screening reactors, and a pilot-scale gas-to-alcohol reactor system that will be modified for liquids input for this project.

The EERC distillation unit comprises numerous distillation flasks ranging in size from 2 to 12 L in volume, a 2-in. fractionation column, a high-capacity condenser, and a fractionating receiver. The system is capable of both atmospheric and vacuum distillation. Operational boundaries are a temperature maximum of 300°C and a pressure minimum of 30 torr. The entire unit is computer-controlled with sophisticated data acquisition software.

The EERC process chemistry screening reactor system is primarily used for chemical process optimization and catalyst lifetime assessment and comprises four identical units installed in parallel. Each unit includes a feed pot, liquid pump, gas mass flowmeter, reactor vessel (typically filled with a fixed bed of catalyst), and product collection pot along with required instrumentation. Because this reactor system requires minimal supervision, it allows the type of long-duration testing that is required to analyze product changes over time as well as catalyst deactivation. These reactors have an operating range as follows: nominal feed rate: 0–10 mL/hr, nominal temperature: 0°–800°F (0°–425°C), and pressure: 0–1000 psig.

The pilot-scale system to be used in this project is illustrated in Figure 2 as it was originally designed. This system will be modified to accept liquid inputs along with other needed modifications to enable CAC process operation including recycle of unreacted ethanol and product intermediates.

Resources:

The EERC is a research facility that operates as a business unit of the University of North Dakota (UND). The EERC has contract funding of $24.5 million, has worked with over 1280 clients in 52 countries, and has a multidisciplinary staff of 235 with expertise in a broad spectrum of energy and environmental programs, including over 60 years of research experience on fuel properties and variability; gasification processes; fuel ash-related impacts; synthetic fuels from coal and biomass; CO_2 sequestration; the fate of

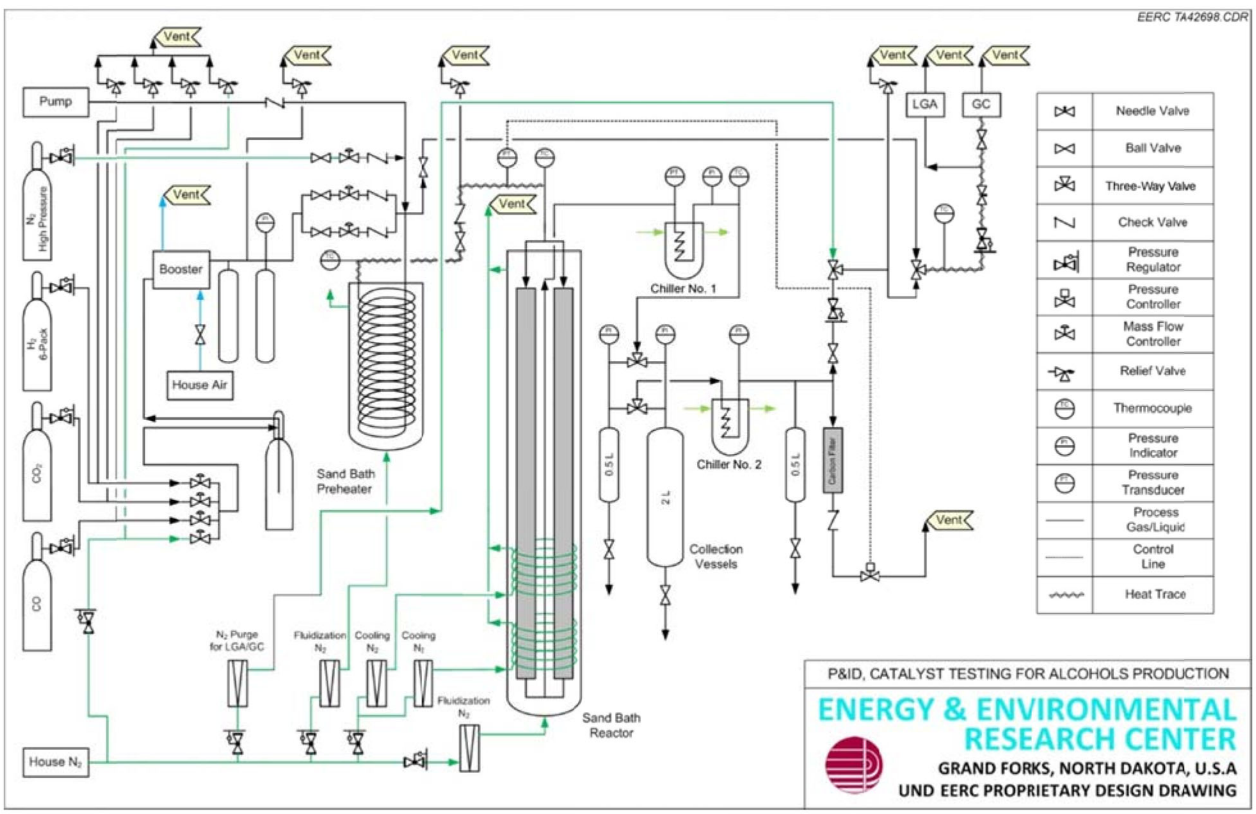

Figure 2. Pilot-scale system to be modified for this project.

pollutants including Hg, particulates, and acid gases; Hg sampling, measurement, and speciation; development, demonstration, and commercialization of combustion and environmental control systems; conducting field testing and demonstrations; and advanced analysis of materials.

All of the equipment necessary for the proposed project will be made available to the project as a priority to ensure the project is able to be completed in a timely and efficient fashion.

Techniques to Be Used, Their Availability, and Capability:

Catalyst Optimization. Preparation of catalysts will be performed with varying active element ratios using an EERC-developed hydrothermal treatment process or a sol-gel synthesis process. Each selected catalyst will be prepared in approximate 100-gram quantities for evaluation in the laboratory-scale testing configuration. The amounts of reactants will be adjusted to achieve active element ratios between 1.0 and 2.0. These catalysts will be analyzed by basicity measurements, x-ray diffraction, and elemental analyses to evaluate the effects of temperature, pH, and thermal treatment time on catalyst structure, composition, reactivity, selectivity, and stability. These catalysts will also be evaluated for potential enhancements through metal and/or metal oxide for improved hydrogen transfer and reduced reaction temperature requirements. A test matrix will be constructed for testing of the catalyst at bench scale In this proposed work, all of the materials entering and leaving the reactors at both the bench and pilot scale will be accounted for and a mass balance performed around the reactor. All reacted and unreacted gases, liquids, and solids will be collected at the exit of the bench-scale reactor and analyzed for composition. Based on these results selectivity, efficiency, and other details of the catalyst performance will be calculated.

Pilot-Scale Testing. Evaluation of catalysts will utilize the previously fabricated reactor and gas chromatography (GC) configuration. Direct analysis of product streams at regular intervals will be conducted to evaluate catalyst performance. Variables including temperature, flow rates, feed composition, and carrier gas composition will be evaluated for impact on yield and selectivity. At the exit of the pilot-scale reactor, all gases leaving will be analyzed with a liquid gas analyzer throughout the test runs for the process optimization. Periodic liquid and gas samples will also be collected and kept for a more rigorous analysis using GC and GC–mass spectroscopy (MS).

Analysis of Materials. Analysis of feed mixtures and products will be carried out utilizing a GC–flame ionization detector (FID) and a GC–MS. The GC is instrumented with a 30-m-long narrow-bore DB-1 glass column with a 0.320-mm i.d. and 0.25-µm phase thickness. The GC–MS analysis will be carried out using a 30-m-long narrow-bore DB-5 glass column with 0.320-mm i.d. and 0.25-µm phase thickness, supplied by J&W Scientific. Prior to analyzing the reactants and produced materials, a solution comprising equal volumes of methanol, ethanol, propanol, isobutanol, and butanol will be analyzed by utilizing the furnace and reactor setup design under the same experimental conditions as used for the condensation reaction experiments, with no catalyst charged in the reactor. Four different flow rates of nitrogen, 50, 75, 100, and 150 cm^3/min, will be used to create a calibration table. This calibration table will be used for quantitative analysis of the condensation products obtained during the catalytic reactions.

Environmental and Economic Impacts While Project Is under Way:

Since this is a laboratory- and pilot-scale project, it is anticipated that there will be no adverse environmental or economic impacts while the project is under way. This project will take place at the EERC in existing laboratories. Only minor amounts of chemicals will be utilized for this project and will be disposed of according to standard laboratory practices and university and state regulation. These chemicals are stored in approved chemical storage cabinets with proper signage for the chemicals being stored in approved laboratory space. All experiments will take place in a laboratory fume hood or specially designed laboratory space with appropriate safety procedures and venting. Personal protective equipment is used in laboratories as appropriate for the work performed. UND and the EERC have existing written programs and training procedures. Activities are monitered by the UND and EERC safety officers. Safety training is routinely conducted for EERC staff working with process equipment. No additional specialized training will be required for personnel working in support of the proposed project.

Ultimate Technological and Economic Impacts:

The CAC process avoids difficulties associated with fermentation-based butanol/isobutanol production by utilizing ethanol as a feedstock, thereby leveraging ethanol industry technical advancements and infrastructure. Because CAC process implementation will build on existing infrastructure, project success will offer the potential of commercial butanol/isobutanol production at minimal capital investment. This will result in additional revenue for existing ethanol plants and the potential to expand alcohol production in North Dakota, producing a diversity of investment opportunity for agriculture while creating more jobs in the state.

Why the Project Is Needed:

North Dakota produces approximately 400 million gallons of ethanol annually. Based solely on ethanol utilization in E10 and E15 blends, ethanol market expansion opportunities are limited. One avenue to expanded opportunity involves the use of ethanol and ethanol production infrastructure to produce advanced biofuels and chemicals such as normal butanol, isobutanol, and other higher-value products. Butanol is considered by the U.S. Department of Energy (DOE) as an advanced biofuel and the next generation of sustainable fuels. Butanol has approximately 25% more energy per gallon when compared to ethanol, allowing for higher efficiency when used as a fuel. However, butanol has more uses than just as a fuel. Made from petroleum, butanol sells wholesale for about 1.5 to 5 times the price of ethanol and is used as a chemical intermediary in the production of latex paints, solvents, synthetic resins, plasticizers, and brake fluids, and the current U.S. butanol market is about 300 million gallons a year and predicted to grow. Production of butanol as proposed in this project may provide the opportunity needed to continue to push the green economy forward in North Dakota by providing new markets for existing ethanol producers as well as providing incentive for new plants to be constructed.

STANDARDS OF SUCCESS

Listed below are the measurable deliverables for the project. Project success will culminate in a design for a demonstration system to be deployed at a participating ethanol production facility that will be implemented in a second phase of this project. This demonstration phase will prove out the technology at a commercial-scale facility, providing the basis for full-scale commercial deployment of the technology.

Deliverables:

Deliverables for this proposed project will include:

- Quarterly progress reports.
- CAC demonstration system preliminary design.
- Presentation of results to project sponsors.
- A final project report including results of economic viability assessment and a funding strategy for deployment of a CAC demonstration system at a commercial ethanol plant.

Value to North Dakota:

In a recent study commissioned by the North Dakota Commerce Department, IHS Global, Inc., conducted a third-party in-depth market and feasibility analysis of the ethanol market in North Dakota, both on a national and global scale. An ultimate goal was to determine how to add value to North Dakota's ethanol industry by developing and commercializing new product streams, niche markets/opportunities that would be compatible with the state's resources and capabilities. It also intended to help define investment opportunities in North Dakota, perhaps providing incentive for industries related to ethanol production to be attracted to North Dakota.

The study concluded that growth in the U.S. demand for biobased chemicals will drive significant production capacity (supply) additions of commodity chemicals and polymers. In particular, commodity chemical intermediates (butadiene, n-butanol) show great promised for business development. The IHS report showed a significant return on investment by developing industries related to butanol production. The EERC-proposed project is directly in concert with this study's findings and suggestions regarding adding value to North Dakota. Successful deployment of this technology in North Dakota will bring new revenue streams to existing ethanol production facilities and provide incentive for expansion of these facilities as well as construction of new facilities. This will provide security for existing jobs at these plants while adding new jobs to handle the increase in production and new product streams.

BACKGROUND/QUALIFICATIONS

Project Team:

The proposed EERC project team has developed the proof-of-concept study, built the reactor system to perform the experimental work, performed the experimental work, analyzed the results, and produced reports and papers to document CAC process development progress (1–4). Commercial Partners Guardian Energy and Hankinson Renewable Energy will provide the ethanol production and market potential expertise for the project.

Prior Experience:

In addition to performing the proof-of-concept work described above, the project team—in cooperation with EERC colleagues—has designed and built several laboratory/pilot-scale reactor systems for process development, including a Fischer–Tropsch (FT) fixed-bed reactor system for testing (commercial and EERC-developed) FT catalysts (5), a pilot-scale direct liquefaction system capable of generating about 2 gallons/day of jet fuel distillation-range raw liquids, and a system to convert up to 4 liters/hour of triacylglyceride feedstock to jet fuel.

MANAGEMENT

The EERC has a long history of successfully managing projects with multiple partners both large and small. The EERC has partnered and worked with many ethanol producers including Archer Daniels Midland, Blue Flint Energy, ICM, Lanzatech, and Chippewa Valley Ethanol Company. The EERC has also partnered with other international organizations, including Siemens, GE, and 3M, and been awarded many DOE, the U.S. Environmental Protection Agency, the U.S. Department of Agriculture, the Department of Defense/Defense Advanced Research Program Agency, and ARPA-E competitive contracts.

Dr. Bruce Folkedahl will be the project manager for this proposed project. Dr. Folkedahl has managed many large projects such as the EERC Center for Biomass Utilization®, a multiyear,

$10,000,000 DOE project with 15 commercial sponsors, a $1,400,000 project for development of a novel water capture technology for power production with Siemens Power and DOE as partners, and numerous other projects in his 15 plus years of experience at the EERC.

Evaluation points during the project will occur at Milestone 2 and Milestone 3 as depicted in Table 2. At these points, the project team will make the decision to proceed or to halt the project based on the success of the project at that juncture. For Milestone 2, the project will proceed if the catalyst optimization has produced a catalyst that has the ability to sustain sufficient catalyst activity to maintain desired conversion efficiency for at least 24 hours of operation and to be effectively regenerated though a simple in-bed treatment procedure. For Milestone 3, the project will proceed if the pilot-scale testing has provided sufficient evidence to support the development of a demonstration-scale design.

TIMETABLE

As shown in Table 2, the project will be completed in 1 year.

Table 2. Project Milestones

Milestone	Description	Achieved By (Month)
1	Kickoff meeting with project sponsors	1
2	Lab-scale process optimization	5
3	Pilot-scale process demonstration	8
4	Economic viability assessment	9
5	Demonstration system preliminary design	10
6	Project results presentation to sponsors	11
7	Final report to sponsors	12

BUDGET

For budget justification, see Appendix A.

CATEGORY	NDIC Renewable Energy Share	National Corn Growers Share	Ethanol Producers Share	Project Total
Labor	$ 225,255	$ 111,342	$ 118,322	$ 454,919
Travel	$ -	$ 1,875	$ -	$ 1,875
Supplies	$ 15,050	$ 3,342	$ 4,658	$ 23,050
Other*	$ 188	$ 96	$ 182	$ 466
Laboratory Fees & Services				
Process Chemistry & Development Lab	$ 7,600	$ 2,128	$ 5,942	$ 15,670
Graphics Service	$ 402	$ 186	$ 130	$ 718
Shop & Operations Fee	$ 1,505	$ 1,031	$ 766	$ 3,302
Total Project Costs – U.S. Dollars	$ 250,000	$ 120,000	$ 130,000	$ 500,000

*May include costs such as food, printing, communications, or other miscellaneous expenses.

TAX LIABILITY

The EERC, a department within the University of North Dakota, is a state-controlled institution of higher education and is not a taxable entity; therefore, it has no tax liability.

CONFIDENTIAL INFORMATION

There is no confidential information in this proposal.

PATENTS/RIGHTS TO TECHNICAL DATA

The EERC has filed a provisional patent on the catalyst and process from previous work under separate contract. Any further patentable material to come from the project will remain the property of the EERC and the EERC Foundation®.

REFERENCES

1. Olson, E.S.; Sharma, R.K.; Aulich, T.R. The Higher-Alcohols Biorefinery: Improvement of the Catalyst for Ethanol Conversion. *Appl. Biochem. Biotechnol.* **2004**, *113–116*, 913–932.
2. Olson, E.S.; Sharma, R.K.; Aulich, T.R. Ester Fuels and Chemicals from Biomass. *Appl. Biochem. Biotechnol*. **2003**, *105–108*, 843–851.
3. Olson, E.S.; Sharma, R.K.; Timpe, R.C.; Aulich, T.R. High-Cetane Diesel Fuels from Biomass. In *Proceedings of the 27th Symposium on Biotechnology for Fuels and Chemicals*; May 1–4, 2005.
4. Olson, E.S. Parallel Processing Biorefineries. *Prepr. Pap.—Am. Chem. Soc., Div. Fuel Chem*. **2005**, *50* (2).
5. Folkedahl, B.C.; Snyder, A.C.; Strege, J.R.; Bjorgaard, S.J. Process Development and Demonstration of Coal and Biomass Indirect Liquefaction to Synthetic Iso-Paraffinic Kerosene. *Fuel Process. Technol.* **2011,** *92*, 1939–1945.

APPENDIX A

BUDGET JUSTIFICATION

ENERGY & ENVIRONMENTAL RESEARCH CENTER (EERC)

BACKGROUND

The EERC is an independently organized multidisciplinary research center within the University of North Dakota (UND). The EERC 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.

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.) and among funding sources of the same scope of work is for planning purposes only. The project manager may incur and allocate allowable project costs among the funding sources for this scope of work in accordance with Office of Management and Budget (OMB) Circular A-21.

Escalation of labor and EERC recharge center rates is incorporated into the budget when a project's duration extends beyond the university's current fiscal year (July 1 – June 30). 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: Salary estimates are based on the scope of work and prior experience on projects of similar scope. Salary costs incurred are based on direct hourly effort on the project. As noted in the UND EERC Cost Accounting Standards Board Disclosure Statement, administrative salary and support costs which can be specifically identified to the project are direct-charged and not charged as facilities and administrative (F&A) costs. Costs for general support services such as contracts and IP, accounting, human resources, procurement, and clerical support of these functions are charged as F&A costs.

Fringe Benefits: Fringe benefits consist of two components which are budgeted as a percentage of direct labor. The first component is a fixed percentage approved annually 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 may include site visits, fieldwork, meetings, and conferences. Travel costs are estimated and paid in accordance with OMB Circular A-21, Section 53, and UND travel policies, which can be found at http://und.edu/finance-operations (Policies & Procedures, A–Z Policy Index, Travel). Daily meal rates are based on U.S. General Services Administration (GSA) rates unless further limited by UND travel policies; other estimates such as airfare, lodging, etc., are based on historical costs. Miscellaneous travel costs may include taxis, parking fees, Internet charges, long-distance phone, copies, faxes, shipping, and postage.

Supplies: Supplies include items and materials that are necessary for the research project and can be directly identified to the project. Supply and material estimates are based on prior experience with similar projects. Examples of supply items are chemicals, gases, glassware, nuts, bolts, piping, data storage, paper, memory, software, toner cartridges, maps, sample containers, minor equipment (value less than $5000), signage, safety items, subscriptions, books, and reference materials. General purpose office supplies (pencils, pens, paper clips, staples, Post-it notes, etc.) are included in the F&A cost.

Communications: Telephone, cell phone, and fax line charges are included in the F&A cost; however, direct project costs may include line charges at remote locations, long-distance telephone charges, postage, and other data or document transportation costs that can be directly identified to a project. Estimated costs are based on prior experience with similar projects.

Printing and Duplicating: Page rates are established annually by the university's duplicating center. Printing and duplicating costs are allocated to the appropriate funding source. Estimated costs are based on prior experience with similar projects.

Food: Expenditures for project partner meetings where the primary purpose is dissemination of technical information may include the cost of food. The project will not be charged for any costs exceeding the applicable GSA meal rate. EERC employees in attendance will not receive per diem reimbursement for meals that are paid by project funds. The estimated cost is based on the number and location of project partner meetings.

Operating Fees: Operating fees generally include EERC recharge centers, outside laboratories, and freight.

EERC recharge center rates are established annually.

Laboratory and analytical recharge fees are charged on a per-sample, hourly, or daily rate. Additionally, laboratory analyses may be performed outside the university when necessary. The estimated cost is based on the test protocol required for the scope of work.

Graphics recharge fees are based on an hourly rate for production of such items as report figures, posters, and/or images for presentations, maps, schematics, Web site design, brochures, and photographs. The estimated cost is based on prior experience with similar projects.

Shop and Operation recharge fees cover expenses of a designated group of individuals whose roles require specialized safety training and personal safety items. These individuals perform project activities in a pilot plant facility, remote location or laboratory and are also responsible for preserving a safe working environment in those areas. The rate includes such things as training for use of fall protection harnesses and respirators, CPR certification, annual physicals, protective clothing/eyewear, hazardous waste disposal fees, and labor for personnel to direct group activities. The estimated cost is based on the number of hours budgeted for this group of individuals.

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

Facilities and Administrative Cost: The F&A rate proposed herein is approved by the U.S. Department of Health and Human Services and is applied to modified total direct costs (MTDC). MTDC is defined as total direct costs less individual capital expenditures, such as equipment or software costing $5000 or more with a useful life of greater than 1 year, as well as subawards in excess of the first $25,000 for each award.

Required Funding: If funding less than what is requested is allocated, the project scope will need to be revised to reflect the lower funding level.