

**Environment and Natural Resources Trust Fund
2010 Request for Proposals (RFP)**

LCCMR ID: 189-F

Project Title:

Solar Energy Demonstration/Education for Minnesota Citizens

LCCMR 2010 Funding Priority:

F. Environmental Education

Total Project Budget: \$ \$213,000

Proposed Project Time Period for the Funding Requested: 1 year, 2010 - 2011

Other Non-State Funds: \$ \$0

Summary:

This project will educate a broad audience in the area of solar energy through innovative demonstration, teaching, and outreach platforms. Children and adults will benefit immediately from the project's deliverables.

Name: Ted Pappenfus

Sponsoring Organization: U of MN - Morris

Address: Div of Science and Mathematics, 600 E 4th Street
Morris MN 56267

Telephone Number: (320) 589-6340

Email: pappe001@morris.umn.edu

Fax:

Web Address: <http://cda.morris.umn.edu/~pappe001/>

Location:

Region: Statewide

County Name: Statewide

City / Township: Statewide

_____ Knowledge Base	_____ Broad App.	_____ Innovation
_____ Leverage	_____ Outcomes	
_____ Partnerships	_____ Urgency	_____ TOTAL

MAIN PROPOSAL: University of Minnesota, Morris

PROJECT TITLE: Solar Energy Demonstration/Education for Minnesota Citizens

I. PROJECT STATEMENT

Among renewable energy resources, solar energy is by far the largest exploitable resource available to us. For example, more energy from the sun hits the earth in an hour than all of the energy consumed on earth in a year. In order to solve our current energy crisis, the exploitation of solar energy must play a more prominent role. This project will specifically focus on photovoltaic technologies which are those that convert sunlight into electricity. The main goal of this project is to educate a broad audience of learners in the area of solar energy through innovative demonstration, teaching, and outreach platforms for Minnesota children and adults.

This NEW project complements and enhances existing and planned renewable energy initiatives such as those on the U of MN, Morris campus and the U of MN West Central Research and Outreach Center. Moreover, this project does not compete with those existing or planned projects. The goals and impacts of the project are summarized below:

- Develop outdoor solar electric laboratories as a way to produce renewable energy and reduce carbon emissions. This “living laboratory” will serve a broad audience (K-adult) and a broad region for educational and demonstration purposes. Citizens not able to travel to Morris will be able to access the laboratories and data online in real-time 24 hr/day.
- Develop indoor learning modules for K-12 students as a way to teach the scientific principles of the outdoor laboratory including the impact of solar energy on climate change. Students will become literate in the basic science of solar energy conversion and the reduction of greenhouse gas emissions. The modules will be tested by local students and will be made available to educators across Minnesota via electronic communication and a project website.
- Develop continuing education courses in solar energy for adults to educate and encourage citizens to adopt renewable energy technologies. Adults will become literate in the basics of solar energy conversion for residential and commercial applications. The course will be available to all adult citizens of MN (first offering in spring 2011 and annually thereafter). Adults unable to travel to Morris will have an online option for taking the course (first offering in summer 2011 and annually thereafter).
- Place the outdoor laboratory online and develop an interactive website for the project to benefit the initial partners as well as to allow partners statewide to participate in the project.
- Evaluate the important measurable outcomes of the project: (a) Are citizens becoming more literate in solar energy principles/practices as a result of this project? (b) Does this project contribute positively to the environmental education knowledge base available to MN citizens?

II. DESCRIPTION OF PROJECT RESULTS

Result 1: Solar Energy Demonstration: Development of Outdoor Laboratories. **Budget:** \$142,400. Two types of small scale outdoor solar energy laboratories will be constructed on the University of Minnesota, Morris (UMM) Campus: a dual-axis tracker system (3 kW) and a fixed-roof mounted system (9 kW). The systems were chosen to highlight both the economic and scientific considerations of each laboratory. For example, the tracker system is more expensive but more efficient than the less efficient, less expensive fixed-mounted system. A monitoring system will also be installed to track the performance of both systems through the internet. The net 12 kW system will produce approx. 1000 kW/mo. (near the average US household usage).

Deliverables

	Completion Date
1. Construction of an outdoor tracker solar laboratory	September 2010
2. Construction of an outdoor fixed array solar laboratory	September 2010
3. Installation of monitoring systems for tracking both laboratories	October 2010

Result 2: Solar Energy Education: Development and Implementation of Teaching Modules, Courses, & Online materials. **Budget:** \$109,229 (incl. UMM contribution). Activities include:

- Teaching modules will be developed for each of the following K-12 audiences: K-3rd grade; 4th-8th grade; and 9th-12th grade. The activities will be classified as beginning, intermediate and advanced. The modules will include experiments and inquiry-based learning activities. The modules will be tested by area students in spring 2011 and then made available to educators across the state through electronic communication and the project website.
- An introductory course for adults will be developed covering the essentials of creating electricity from sunlight. The course will be targeted for a broad audience including educators and homeowners. Evaluation, applications, and the economics of the technology will be covered in the course. The courses will be advertised/distributed utilizing U of MN system-wide resources and also organizations such as the MN Renewable Energy Society.
- A dedicated webpage will be developed outlining the specifics of the project. The website will target and accommodate three unique audiences: children, adults, and educators. The website will be linked through UMM and U of M system-wide sites. The website will also be communicated through educational list serves and social networks such as Facebook.
- Evaluation will be a critical component of this project to gauge its effectiveness. Feedback will be obtained from students, educators, and all users of the outlined deliverables.

Deliverables

	Completion Date
1. Development of K-12 teaching modules	December 2010
2. Development of an adult continuing education courses in solar energy	December 2010
3. Development of a dedicated webpage for the entire proposed project	July 2011

III. PROJECT STRATEGY

A. Project Team/Partners (All partners identified were contacted prior to proposal submission.)

Team Member or Partner	Role
Ted Pappenfus, Associate Professor of Chemistry, University of Minnesota, Morris (On sabbatical 2010-2011 academic year)	Project Manager, Developer of education materials and web-based materials, Instructor for K-12 and adult modules and courses
Troy Goodnough, UMM Sustainability Coord.	Coordinate K-12 and adult ed. activities
Morris Area Public Schools	Student participation in K-12 teaching modules
Cyrus Math, Science and Technology School	Student participation in K-6 teaching modules
UMM Continuing Education	Advertise/distribute the adult course
UMM Plant Services	Oversee the construction of outdoor labs
Innovative Power Systems	Install solar power systems for outdoor labs

B. Timeline Requirements

July - Aug. 2010	Project Begins; finalize details for outdoor lab development and installation; begin development of adult courses
Aug. - Oct. 2010	Construct outdoor solar laboratories; installation of monitoring systems; development of K-6 teaching modules
Oct. - Dec. 2010	Monitor functioning outdoor laboratories; develop K-12 teaching modules; continue development of adult continuing education courses
Jan. - May 2011	Monitor functioning outdoor laboratories; implement education modules and courses; begin evaluation of deliverables
June - July 2011	Develop online materials for the project; revise and improve materials tested in the spring; teach online continuing education course for adults; project evaluation

C. Long-Term Strategy

The long-term strategy is based on the projected lifetime for the outdoor laboratories of 25-30 years and UMM's commitment to energy research and sustainability. This one-time investment in solar education will remain a strong teaching and informational tool for UMM and statewide K-12 students and adults. The institution, UMM Plant Services, and the UMM Division of Science and Math are committed to maintain and continue educational efforts in solar technology.

Project Budget

University of Minnesota, Morris

Project Title: Solar Energy Demonstration/Education for Minnesota Citizens

IV. TOTAL PROJECT REQUEST BUDGET (1 year)

BUDGET ITEM	AMOUNT
Personnel:	\$ -
(a.) Ted Pappenfus - Academic year salary and fringe (Salary: 9 mo. @ 50% time; \$3,281.70 /mo. salary plus 32.3% fringe. Pappenfus will be on sabbatical during the 2010-11 academic year and will work 100% full time on this project over the nine month academic year. This request will supplement the <i>unpaid</i> portion of the sabbatical. The U of MN will fund the remaining 50% of the salary for the academic year. Pappenfus will serve as the project manager, will design the educational modules and courses, and will be the instructor for these activities as described in the main proposal. Pappenfus will also develop assessment and evaluation tools.	\$ 39,075
(b.) Troy Goodnough - Academic year salary and fringe (Salary: 4.5 mo. @ 22% time; \$690.44/mo. salary plus 32.3% fringe). Goodnough will work on this project during the Spring 2011 semester coordinating all educational activities in Spr. 2011.	\$ 4,110
(c.) Ted Pappenfus - Summer salary and fringe (Salary: 3 mo. @ 100% time; \$6,511.67/mo. salary plus 20.14% fringe). Pappenfus will serve as the project manager, will design the educ. modules & courses, & will be the instructor for these activities as described in the main proposal. Note: Ted is on a 9 mo. contract.	\$ 23,469
Contracts:	\$ -
Outdoor solar laboratories and installation: One contract will be made with a solar electric systems installer to provide the following: (a) 3.0 kw dual-axis tracker outdoor laboratory (\$39,000); (b) 9.0 kw fixed roof mount outdoor laboratory (\$90,000); (c) Monitoring system (internet interfaced) for the two outdoor laboratories (\$3,400). Prices are based on estimates from two independent companies in Minnesota: Innovative Power Systems and Westwood Renewables.	\$ 132,400
Structural Engineer Services to assess the roof-top mounting system and the building integrity to support the system.	\$ 3,000
Equipment/Tools/Supplies:	\$ -
Teaching and laboratory supplies and small laboratory equipment for K-12 and adult teaching modules.	\$ 3,500
Additional Budget Items:	\$ -
(a.) University of Minnesota, Morris Plant Services (Installation of fence around outdoor tracker laboratory; Installation of permanent outdoor sign for the laboratory)	\$ 5,000
(b.) University of Minnesota, Morris Computing Services (Assistance with network connection of outdoor laboratory monitoring systems)	\$ 500
(c.) Building permit for installation of outdoor solar laboratories	\$ 1,500
TOTAL PROJECT BUDGET REQUEST TO LCCMR	\$ 212,554

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Other State \$ Being Applied to Project During Project Period: ESCO contract providing UMM with the software to produce real-time, online energy output and information online. The contract is \$70,000. This project will use this software for the online component.	\$ -	<i>Secured</i>
In-kind Services During Project Period: Ted Pappenfus will be working full-time on this project over the course of the project period. The in-kind salary contribution is his sabbatical salary paid by UMM (50% salary and fringe).	\$ 39,075	<i>Secured</i>

Project Manager Qualifications and Organization Description: University of Minnesota, Morris

PROJECT TITLE: Solar Energy Education and Demonstration for K-12 and Adult Audiences

Project Manager Qualifications:

Ted M. Pappenfus, Ph.D.
Associate Professor of Chemistry
Division of Science and Mathematics
University of Minnesota, Morris

College and University Education

Postdoctoral Research Associate (January 2002-July 2003). Department of Chemical Engineering and Materials Science, University of Minnesota, Twin Cities.

Ph.D., Inorganic Chemistry (December 2001). Department of Chemistry, University of Minnesota, Twin Cities.

B.A., Chemistry (1995). Saint John's University, Collegeville, MN.

Professional Employment

Associate Professor of Chemistry (August 2008-present)
Division of Science and Mathematics, University of Minnesota, Morris

Assistant Professor of Chemistry (August 2003-August 2008)
Division of Science and Mathematics, University of Minnesota, Morris

Postdoctoral Research Associate (January 2002-July 2003)
Department of Chemical Engineering and Materials Science, University of MN, Twin Cities

Education-Related Activities

Dr. Pappenfus has been the principal investigator on a variety for externally funded grants related to education including the following: National Science Foundation - Course Curriculum and Laboratory Improvement (NSF-CCLI), "Integration of Conducting Polymers Across the Undergraduate Chemistry Curriculum." \$144,273 (January 2006-December 2008).

Dr. Pappenfus has worked with local schools and provided lab-based activities for kindergarten students from Morris Elementary School (Spring 2007, Spring 2008).

Organization Description:

The University of Minnesota, Morris (UMM) is an academically rigorous, rural, public undergraduate liberal arts college that serves a diverse population of approximately 1,700 students. UMM is nationally recognized for providing students with an education comparable to the best private liberal arts colleges in the nation. Relative to the current proposal, UMM is a national leader in the use of sustainable energy resources. The University of Minnesota, Morris is deeply rooted in the tall prairie grass and connected to the blue prairie sky. The campus community has advanced sustainable, environmentally friendly initiatives starting with the first Earth Day. Since 2000, these efforts have grown to levels of national leadership and touch nearly all aspects of campus life - energy, food, water, transportation, waste stream infrastructure, academic study, and quality of life. UMM also boasts strong research programs in this area, with a clear focus on providing our students the opportunity to become future leaders in sustainability.

