



Environment and Natural Resources Trust Fund

2027 Request for Proposal

General Information

Proposal ID: 2027-089

Proposal Title: Energizing the Next Generation Through Experiential Learning

Project Manager Information

Name: Ellen Thompson

Organization: Minnesota State Colleges and Universities - Minnesota State University Mankato

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Project Basic Information

Project Summary: Undergraduate engineering students develop hands-on demonstrations for a children's museum exhibit about renewable energy and climate change, including mailable museum kits and video workshops to improve access across Minnesota.

ENRTF Funds Requested: \$290,000

Proposed Project Completion: June 30, 2031

LCCMR Funding Category: Small Projects (G)

Secondary Category: Energy (E)

Project Location

What is the best scale for describing where your work will take place?

Statewide

What is the best scale to describe the area impacted by your work?

Statewide

When will the work impact occur?

During the Project and In the Future

Narrative

Describe the opportunity or problem your proposal seeks to address. Include any relevant background information.

Interdisciplinary collaboration between policy makers, technical experts, and local stakeholders is critical for Minnesota to develop and sustain its renewable energy transition. However, technical training for the renewable energy sector too often narrows early to particular subdisciplines. Engineering students interested in renewable energy work may tackle extensive coursework in the environmental, electrical, or chemical engineering fields but lack context for how their work fits into the whole energy system. This fosters a younger generation with a limited view of who can contribute in renewable energy engineering and creates a pool of young engineers who are underprepared to design within the complex renewable energy landscape.

This can change if STEM educators design experiential learning activities around open-ended problems instead of disciplines. When we allow students to participate in exploration driven by broad curiosity, motivation and investment grows. They can enhance their learning and extend their impact through K-12 outreach, giving an opportunity for college students to build their communication skills and deliver technical content to a broad audience. This simultaneously enables young learners to engage in hands-on learning. Applying this approach to renewable energy will help the next generation of engineers develop a systems-based approach to the energy challenges of tomorrow.

What is your proposed solution to the problem or opportunity discussed above? Introduce us to the work you are seeking funding to do. You will be asked to expand on this proposed solution in Activities & Milestones.

The Integrated Engineering (IE) department at Minnesota State University, Mankato, is built on an interdisciplinary, project-based approach to engineering education. Students integrate their theoretical learning in math and sciences with real-world engineering projects. This enables them to build context and experience working in complex systems. We propose a series of IE student projects to develop hands-on demonstrations of renewable energy systems, the integration of these demos as an exhibit at a non-profit STEM-focused children's museum in the Twin Cities metro to engage with school-age children and their families, and the adaptation of the exhibits as mailable kits and corresponding video workshops to provide access to these same learning activities for kids across the state.

There are two primary outcomes: First, IE students will build connections between engineering theory, practice, and communication. This will deepen their understanding of real-world energy systems and better prepare them for the renewable energy workforce. Second, young students across the state of Minnesota will engage in hands-on learning about where their energy comes from. This will build a foundation for deeper learning as they grow, fostering engagement and enthusiasm for renewable energy projects in the next generation of engineers, policy makers, and community members.

What are the specific project outcomes as they relate to the public purpose of protection, conservation, preservation, and enhancement of the state's natural resources?

A transition to a sustainable mix of renewable energy sources suitable to regional geography and context is critical for the conservation of Minnesota's natural resources. A cross-generational approach to renewable energy education and engagement will foster a systems-level, community-oriented mindset in the energy workforce. Outreach events will emphasize the importance of natural resource preservation in energy infrastructure development.

Activities and Milestones

Activity 1: Develop student projects to build museum demonstrations

Activity Budget: \$121,000

Activity Description:

The primary output of Activity 1 will be a series of children's museum exhibits developed by IE students for K-12 students to demonstrate renewable energy technologies. This will take place over three academic years. In the first academic year, project teams will design and develop preliminary working prototypes of their demonstrations. The second academic year will allow student project teams to iterate upon their preliminary designs and develop improved demonstrations. In the third year, the project team will work with museum staff to prepare supporting materials and develop the exhibit that will be displayed in year four. The budget will supply funds for student project team supplies and for faculty time in developing learning activities, as well as a subaward for museum staff to contribute to the development of a museum exhibit.

Activity Milestones:

Description	Approximate Completion Date
Project team defines student project expectations and deliverables	August 31, 2027
AY27-28 Student teams construct working prototypes of preliminary exhibit demonstrations	May 31, 2028
AY28-29 Student teams improve upon preliminary demonstration designs	May 31, 2029
Project team and museum staff prepare demonstrations into museum-ready exhibit	May 31, 2030

Activity 2: Develop remote laboratory kits and video demos

Activity Budget: \$87,000

Activity Description:

Concurrent with the improvement of the museum exhibit items, the project team will develop remote laboratory kits and corresponding video-based learning activities for statewide dissemination. These will complement the exhibits developed by the students in order to expand access outside of the Twin Cities metro area. With the kits, students across the state will be able to participate in home versions of the hands-on activities displayed in the museum. In the event that there is more interest than is possible to support through this project, the project team will prioritize sending kits to rural schools with less access to hands-on museum activities. Each kit will be shared by a school class (10-20 students) for about 10 hours of activity time. The activities will be repeatable with the replacement of some low-cost consumables, and the kits will stay on location for continued use by the K-12 students. The budget for this activity will cover supplies and shipping for laboratory kits, as well as faculty time for activity development.

Activity Milestones:

Description	Approximate Completion Date
Project team develops and builds remote laboratory kits	May 31, 2029
Project team develops video demonstrations to complement laboratory kits	August 31, 2029
Project team distributes kits and develops online outreach events	June 30, 2030

Activity 3: Outreach events

Activity Budget: \$82,000

Activity Description:

In the fourth project year, upon completion of the museum exhibit pieces and remote laboratory kits, the project team will host a series of outreach events at a Twin Cities children's museum. The target audience will be K-12 students and their families. A specific K-12 student audience age range will be determined based on the museum partner established in the first project year. Improving access to individuals who are underrepresented in STEM fields will be a priority. Volunteering is a program requirement for IE student engineers at Twin Cities Engineering, and they will be invited to help lead the outreach events. Finally, four months are allotted for project reporting, dissemination, and conclusion, with particular attention to enabling lasting impact as a result of the project efforts and funding. The budget for this activity will support the museum exhibit, travel funds, and faculty time to deliver activities.

Activity Milestones:

Description	Approximate Completion Date
Project team identifies and establishes partnerships with museum(s) for future exhibits	December 31, 2027
Museum displays renewable energy exhibit	December 31, 2030
Project team hosts three outreach events at the Twin Cities museum	February 28, 2031
Project team hosts three virtual outreach events for K-12 students throughout the state	February 28, 2031
Project reporting, dissemination, and conclusion	June 30, 2031

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Professor Jacob Swanson	Minnesota State University, Mankato	Faculty team member - Twin Cities Engineering campus	Yes
Professor Jack Elliott	Minnesota State University, Mankato	Faculty team member -- Iron Range Engineering campus	Yes

Dissemination

Describe your plans for dissemination, presentation, documentation, or sharing of data, results, samples, physical collections, and other products and how they will follow ENRTF Acknowledgement Requirements and Guidelines.

Effective dissemination of the proposed activities will focus on two sets of activities: (1) attendance at museum exhibits by the target K-12 audience, and (2) statewide participation by a K-12 instructor audience in implementing, evaluating, and extending existing educational kits. In all distributions, all media, publications, signage, and other activities provide proper attribution to ENRTF.

The first series of dissemination activities will focus on garnering interest and attendance at the museum exhibitions. This will include leveraging existing museum marketing strategies and expanding these prior efforts through a social media campaign.

The second series of dissemination activities will focus on reaching K-12 educators regarding the availability and applicability of the remote laboratory kits. The project team will document kits and corresponding learning activities in national online repositories including TeachEngineering.org and regional repositories including the MN STEM Ecosystem. Further, we will leverage existing social media marketing resources including Minnesota State University, Iron Range Engineering, and similar accounts to disseminate availability of activities to educators and student audiences. Projects will be posted to hardware and learning repositories including printables.com for broader audiences and to reinforce adaptation and extension to new contexts. Finally, the project team will coordinate iterative design and deployment of the kits with local high schools in the Iron Range and Twin Cities regions.

Dissemination of results for the museum activities and instructional kits will focus on demonstrating the usefulness of the proposed activities in developing K-12 students' interest in and knowledge of renewable energy technologies. The project team will target dissemination results to the local and statewide STEM education communities (e.g., Minnesota Science Teachers Association Annual Conference) Final reporting regarding the relationship of individual activities and relationship to participant outcomes will be provided to the LCCMR through annual formative reports and a summative report Year 4. These efforts will provide valuable accessible and lasting resources for intergenerational experiential learning for the future renewable engineering workforce.

Long-Term Implementation and Funding

Describe how the results will be implemented and how any ongoing effort will be funded. If not already addressed as part of the project, how will findings, results, and products developed be implemented after project completion? If additional work is needed, how will this work be funded?

The museum demos will be stored at the project team's campus and will be available to move to a different museum

location in the future. Supporting documentation and videos from outreach events will be available upon request. After project completion, the mailable kits will be available for purchase at cost. The supporting documentation (kit instructions, learning activities, etc.) will be publicly available on an online repository (e.g., TeachEngineering.org).

Project Manager and Organization Qualifications

Project Manager Name: Ellen Thompson

Job Title: Assistant Professor

Provide description of the project manager's qualifications to manage the proposed project.

Dr. Ellen Thompson is an Assistant Professor at the Iron Range Engineering (IRE) program in the Department of Integrated Engineering at Minnesota State University, Mankato. She completed her PhD at the University of Michigan in 2024 with a focus on subsurface geochemistry for sustainable energy applications. Her current research primarily focuses on inclusive teaching practices, including experiential learning in engineering education. At IRE, she supports project-based learning for undergraduate student design teams, providing guidance as a technical expert, design review panel member, and professional development workshop leader. Iron Range Engineering and its partner program, Twin Cities Engineering (TCE), both prioritize hands-on learning and development. IRE is a work-integrated learning program in which students gain on-the-job experience working full-time in paid engineering co-ops around the country while completing their studies. This makes it particularly well equipped to support student engineers entering the renewable energy workforce. TCE is a project-based learning program in which students complete real-world engineering design projects for industry clients, building professional skills while tackling complex engineering challenges. Dr. Thompson has shown a lifelong commitment to outreach and mentorship for young people in STEM, having volunteered through her own high school years, college, graduate school, and in the workplace to inspire the next generation of engineers. She has particularly focused on outreach to young women and other underrepresented groups in engineering, through events like the Iron Range Engineering #ILookLikeAnEngineer Day. Her combined expertise in environmental engineering, work in experiential learning, and commitment to inclusive outreach make her well-prepared to lead this project to provide inclusive education and experiential learning programs to build a skilled and diverse workforce for the renewable energy sector.

Organization: Minnesota State Colleges and Universities - Minnesota State University Mankato

Organization Description:

Minnesota State University, Mankato (MNSU), is a member of the Minnesota State Colleges and Universities system and enrolls over 14,000 students. At its core, MNSU values student-centered learning and excellence in teaching. Its Destination 2030 Strategic Plan targets diversity, inclusion, and belonging, showing a commitment to equitable teaching practices and resource stewardship. The Integrated Engineering (IE) department at MNSU has two satellite programs – Iron Range Engineering (IRE) in Virginia, MN, and Twin Cities Engineering (TCE) in the Twin Cities. Both IRE and TCE are upper-division undergraduate programs, and all IE students transfer into the programs from community colleges. This structure improves the affordability and accessibility of college education in engineering. IRE and TCE are built on a model of active, experiential learning with real-world integration and intentional workplace preparation. This makes them uniquely positioned to develop the renewable energy workforce of tomorrow.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
Project lead		Lead-specific activities will include project management, team coordination, report writing. Lead will also contribute to student project development, learning activity development, development of laboratory kits, and development of outreach activities.			36%	0.6		\$80,000
Faculty project team member		Student project development, learning activity development, development of laboratory kits, and development of outreach activities.			36%	0.48		\$64,000
Faculty project team member		Student project development, learning activity development, development of laboratory kits, and development of outreach activities.			36%	0.48		\$64,000
Undergraduate student assistant		Assemble mailable kits materials and distribute, assist with logistics and communication as needed			8%	0.15		\$5,000
							Sub Total	\$213,000
Contracts and Services								
Non-profit children's museum	Subaward	Museum staff will assist in creating displays and an interactive exhibit out of the demonstrations developed by students				0.3		\$12,000
							Sub Total	\$12,000
Equipment, Tools, and Supplies								
	Tools and Supplies	Total budget for student projects to build demonstrations, which will cover project supplies (\$2500 per project, 5 projects per year, 2 years).	This includes the development and iteration of the museum exhibit demonstrations.					\$25,000
	Tools and Supplies	Mailable museum kit supplies used to create kits, priced at \$40 per kit for 50 kits.	These supplies will be used directly for mailable lab kits.					\$2,000
	Tools and Supplies	Mailable museum kit contents, priced at \$100 per kit for 50 kits	These will be the consumable contents of the mailable kits, to be distributed to K-12 students across the state.					\$5,000

	Tools and Supplies	Additional supplies for developing the demonstrations into a museum exhibit, including signage and other learning content.	These supplies will be used to develop the demos into a full museum exhibit.					\$15,000
							Sub Total	\$47,000
Capital Equipment								
							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
	Conference Registration Miles/ Meals/ Lodging	Attendance at a Minnesota-based education conference to present project findings and disseminate work - \$1000/person/year for 3 people for 2 years.	Attendance and presentation at local conferences will be essential for dissemination.	X				\$6,000
	Miles/ Meals/ Lodging	Travel between museum (Twin Cities) and primary work location (Iron Range) for two team members. Lodging estimated at \$200 per night per person per trip for two project team members who live in northern Minnesota. Mileage estimated at \$300 per trip (400 miles round trip x 0.725/mile, rounded up). Assume 3 trips per year for last two years of project. Rounded to \$7000 for contingencies.	Travel to museum location for outreach events					\$7,000
							Sub Total	\$13,000
Travel Outside Minnesota								
							Sub Total	-
Printing and Publication								
	Printing	Printing and mailing materials to regional educational institutions.	Materials will be used to disseminate information about program and kits.					\$5,000
							Sub Total	\$5,000
Other Expenses								

							Sub Total	-
							Grand Total	\$290,000

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Travel In Minnesota	Conference Registration Miles/Meals/Lodging	Attendance at a Minnesota-based education conference to present project findings and disseminate work - \$1000/person/year for 3 people for 2 years.	Attendance at local teaching conferences (e.g., Minnesota Science Teachers Association Annual Conference) will be essential for the dissemination of the outcomes of this project, including formal presentation of the mailable kits to a broad and relevant audience. In the final year of the project, conference attendance will allow for broader presentation of project findings and long-term impact.

Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
			State Sub Total	-
Non-State				
			Non State Sub Total	-
			Funds Total	-

Total Project Cost: \$290,000

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: [b97abbd3-97a.pdf](#)

Alternate Text for Visual Component

A map of Minnesota that shows a museum icon in the Twin Cities surrounded by renewable energy symbols (wind turbine, battery, solar panel). Arrows point outward from the museum to show packages being mailed to schools around the state. Text says "Energizing the next generation through experiential learning."...

Administrative Use

Does your project include restoration or acquisition of land rights?

No

Do you understand that travel expenses are only approved if they follow the "Commissioner's Plan" promulgated by the Commissioner of Management of Budget or, for University of Minnesota projects, the University of Minnesota plan?

Yes, I understand the Commissioner's Plan applies.

Does your project have potential for royalties, copyrights, patents, sale of products and assets, or revenue generation?

No

Do you understand and acknowledge IP and revenue-return and sharing requirements in 116P.10?

N/A

Do you wish to request reinvestment of any revenues into your project instead of returning revenue to the ENRTF?

N/A

Does your project include original, hypothesis-driven research?

No

Does the organization have a fiscal agent for this project?

No

Does your project include the pre-design, design, construction, or renovation of a building, trail, campground, or other fixed capital asset costing \$10,000 or more or large-scale stream or wetland restoration?

No

Do you propose using an appropriation from the Environment and Natural Resources Trust Fund to conduct a project that provides children's services (as defined in Minnesota Statutes section 299C.61 Subd.7 as "the provision of care, treatment, education, training, instruction, or recreation to children")?

Yes

Do you certify that background checks are performed for background check crimes, as defined in Minnesota Statutes, section 299C.61, Subd. 2, on all employees, contractors, and volunteers who have or may have access to a child to whom children's services are provided by your organization?

Yes

Provide the name(s) and organization(s) of additional individuals assisting in the completion of this proposal:

No one not already listed.

Do you understand that a named service contract does not constitute a funder-designated subrecipient or approval of a sole-source contract? In other words, a service contract entity is only approved if it has been selected according to the contracting rules identified in state law and policy for organizations that receive ENRTF funds through direct appropriations, or in the DNR's reimbursement manual for non-state organizations. These rules may include competitive bidding and prevailing wage requirements

N/A