

Environment and Natural Resources Trust Fund

2026 Request for Proposal

General Information

Proposal ID: 2026-329

Proposal Title: Making Solar Work for Minnesota Dairy Farmers

Project Manager Information

Name: Eric Buchanan Organization: U of MN - WCROC Office Telephone: (320) 589-1711 Email: buch0123@morris.umn.edu

Project Basic Information

Project Summary: Solar array (~250 kW) using several options to optimize grazing with dairy cows will develop data for pasture forage, dairy cow management, and energy production allowing replication by other farmers.

ENRTF Funds Requested: \$1,443,000

Proposed Project Completion: June 30, 2029

LCCMR Funding Category: Energy (E)

Project Location

What is the best scale for describing where your work will take place? Region(s): SW

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.

The proposed project is important for demonstrating dual benefit solutions to real and perceived barriers to large renewable energy projects in rural areas. One barrier to increased solar energy production is community opposition to multi-acre solar developments driven in part by a lack of local benefits and prime farmland being taken out of production. Co-locating solar panels with agricultural activities—agrivoltaics (AVs)—can address these barriers to adoption and potentially improve the economics of farming by adding a new income stream Compromises are often made with agrivoltaic solar arrays by either modifying the standard design for an array focused only on energy, or by selecting the most benign agricultural activities employed, like pollinator habitat or sheep grazing, are not of sufficient scale in production agriculture to meaningfully address national clean energy goals. We propose to design, demonstrate, and collect data for several novel approaches that could allow agrivoltaic solar arrays

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.

to scale profitably to the over 4 million acres of pastureland in Minnesota alone.

An approximately 250 kW agrivoltaic solar array will be mounted on single axis trackers and installed in an organic cow pasture. The array will be configured to evaluate 3 methods to address issues involving cow/array interactions. One portion of the array will be installed as if the pasture was converted to only solar as a control and this portion will also be tested with modified cow management practices. Another portion of the array will be outfitted with custom designed bracketing to mount electric fence wires in a configuration to protect panel edges when they are tilted within range of curious cows. A third portion of the array will be elevated to prevent cow interaction. An innovative technology, virtual fencing, will also be tested with the array. It may be possible to dynamically change the borders of the allowable grazing area for cows wearing virtual fence devices to keep cows from tilted panel edges and still allow grazing and shade access under the array. All cow/environment data will be combined with energy production and array cost information to develop optimized grazing systems and best practices that can be replicated by other dairy farmers.

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?

Demonstrating ways to allow farming and energy production on the same land will help MN meet its clean energy goals without compromising natural lands or prime farmland. Opening the over 4 million acres of MN grazing land to clean energy production will also lessen impacts that would otherwise be experienced from the expansion of fossil-fueled energy production. Moreover, creating new economic opportunities for rural farmers will help keep pastureland in production, keep family farms on the land strengthening rural communities, and slow the sale of grassland to outside developers.

Activities and Milestones

Activity 1: Design, Procure, and Install Solar Array and Cow Interaction Treatments with Sensors

Activity Budget: \$1,013,000

Activity Description:

The centerpiece of this project will be an approximately 255 kW-dc agrivoltaic solar array consisting of panels mounted on single axis trackers installed in an organic cow pasture covering about 1 acre of the 12-acre pasture. The array will be partitioned into 3 different physical configurations of about 85 kW-dc each, to evaluate methods to address issues involving cow/array interactions. Each partition will consist of 6 rows of panels mounted to an independent, single axis about 98 feet (30 meters) long. Rows will be spaced about 25 feet (8 meters) apart. Row length and row spacing will not be altered in any of the partitions. Partitions will be configured as follows:

1. No change to normal all-solar configuration used to maximize energy production.

2. Brackets will be designed, fabricated, and attached to panel edges to support an electric fence arranged to prevent cow interaction when panel edges are within cow reach.

3. Panels will be raised out of cow reach by lengthening support poles

An array layout and utility interconnection plan will be developed in addition to designs for cow/panel interaction modifications. An RFP will be released for the solar array followed by vendor selection and installation.

Activity Milestones:

Description	Approximate Completion Date
Solar array layout and interconnection plan	October 31, 2026
Release RFP for solar array and select vendor	December 31, 2026
Design and fabricate electric fence brackets	December 31, 2026
Install solar array	June 30, 2027

Activity 2: Manage Cows Grazing under Array, Collect Data, and Develop Best Practices

Activity Budget: \$430,000

Activity Description:

The study will be conducted over two grazing seasons from spring through the fall. Ninety-six Holstein and crossbred cows will be enrolled and separated into four balanced and replicated groups, each consisting of 24 cows. Each group of cows will be allocated a separate paddock of about 2.5 acres within the same overall pasture. Cows will be assigned to one of two treatments: Shade or No-Shade from one of the solar array partitions.

Sensors will be installed to measure and record air temperature, relative humidity (RH), wind speed and direction, soil temperature and moisture, and solar irradiation in addition to monitoring energy and forage production. A whole suite of data will be collected from grazing cows including fly counts, respiration, hygiene scores, body temperature, milk production, and cow activity. Cows will also be physically monitored by a graduate student.

Virtual fencing collars will be worn by cows to test dynamically changing the grazing boundary allowing cows to access shade when panels are out of reach and restricting access to panel edges within reach of curious cows.

All cow/environment data will be used to develop optimized grazing systems and best practices that can be replicated by other dairy farmers.

Activity Milestones:

Description	Approximate
	Completion Date

Procure sensors and data loggers	March 31, 2026
Install sensors and data loggers	June 30, 2027
Monitor cows and collect data	October 31, 2028
Prepare cow agrivoltaic system design guide and best practices	June 30, 2029

Project Partners and Collaborators

Name	Organization	Role	Receiving
			Funds
Dr. Brad Heins	U of MN WCROC	Dairy Scientist	No

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 WCROC will disseminate results from this project at its annual Organic Dairy Day and Agrivoltaic Field day, as well as the biennial Midwest Farm Energy Conference (2028) as well as producing University of Minnesota Extension bulletins, discussing it on the U of MN podcast, "The Moos Room", and inclusion in periodic agrivoltaic webinars. Ongoing research will be continued with the array as part of WCROC dairy research program using future grant funding.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Agrivoltaics To Improve The Environment And Farm Resiliency	M.L. 2021, First Special Session, Chp. 6, Art. 6, Sec. 2, Subd. 07c	\$646,000
Improving Agricultural Ecosystems through Autonomous Weed Control	M.L. 2024, , Chp. 83, Art. , Sec. 2, Subd. 07c	\$978,000

Project Manager and Organization Qualifications

Project Manager Name: Eric Buchanan

Job Title: Director, WCROC Renewable Energy Program

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

Mr. Buchanan earned a Bachelor of Science degree in Aerospace Engineering from Purdue University and has proven his leadership skills as an engineering supervisor and project manager with 36 years of experience in the aerospace, automotive, medical device, and renewable energy industries. Mr. Buchanan has been leading innovative projects incorporating renewable energy into agricultural systems since 2010 and now directs the renewable energy program. He has managed the installation and interconnection of 5 solar arrays on the WCROC farm site totaling 131 kW. The WCROC Renewable Energy Program has successfully completed over \$30 million in previous grant funding and is currently managing over \$15 million in funded research activity.

Organization: U of MN - WCROC

Organization Description:

The WCROC is part of the University of Minnesota's College of Food, Agriculture, and Natural Science and is part of a network of agricultural experiment stations located around the state. The WCROC farm site is located in west central Minnesota, just outside the city of Morris, on just over 1000 acres including about 640 tillable acres (>300 acres certified organic) and 350 acres of certified organic pasture for about 300 milking cows.

We work with farmers, rural leaders, faculty from throughout the University of Minnesota system, other professionals from industry and academia, and citizens to provide research and educational programming. Working with these many partners is our greatest strength. These partnerships keep us connected to the varied and changing needs of the producers and citizens of Minnesota.

Faculty and staff at the WCROC develop solutions to real-world challenges and then share with local and global

communities. Our primary research areas include agronomy and soil science; dairy; horticulture; renewable energy; and swine. Each year, we welcome several international scholars, producers and visitors to the WCROC including numerous tours with students from elementary school through college age.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineli	% Bene	# FTE	Class ified	\$ Amount
Personnel				ginie	1115		Stall	
Lead PI -		Direct all research and personnel			36.6%	1.5		\$182,242
Professional								
Researcher -								
FTE								
dependent								
on grant								
funds								
Professional		Develop software/automation solutions for cow			36.6%	0.3		\$37,242
researcher -		interaction treatments						
FTE								
dependent								
on grant								
funds								
Professional		DIrect cow management strategies and on-pasture			32.3%	150		\$131,792
Technician -		data collection						
FTE								
dependent								
on grant								
funds								
Professional		Design, fabricate and install cow interaction			32.3%	0.75		\$61,976
Technician		treatments and collect energy data						
Professional		Design, fabricate and install cow interaction			32.3%	0.75		\$46,471
Technician		treatments and collect energy data						
graduate		Assist lead PI, collect cow and environmental sensor			83.6%	3		\$179,501
student		data						
							Sub	\$639,224
							Total	
Contracts and Services								
utility	Service	interconnection of solar array to energy grid				-		\$2,000
	Contract							
tbd solar	Service	provide and install solar array				-		\$750,000
installer	Contract							
							Sub	\$752,000
							Total	

Equipment, Tools, and Supplies							
	Equipment	virtual fencing equipment - software, GPS, cow collars (~\$400 per cow)	To research using dynamic non- physical (GPS) fencing for protecting panels from cows				\$40,000
	Tools and Supplies	Fabricated fence brackets, tools, wires, etc	to modify solar array preventing cow access to panel edges				\$7,500
	Tools and Supplies	environmental sensors and data loggers	Record environmental, energy, and cow derived data				\$4,276
					S T	ub otal	\$51,776
Capital Expenditures							
					S T	ub otal	-
Acquisitions and Stewardship							
					S T	ub otal	-
Travel In Minnesota							
					S T	ub otal	-
Travel Outside Minnesota							
					S T	ub otal	-
Printing and Publication							
					S T	ub otal	-
Other Expenses							
					S T	ub otal	-
					G T	irand otal	\$1,443,000

Classified Staff or Generally Ineligible Expenses

Category/Name Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
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Non ENRTF Funds

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

Total Project Cost: \$1,443,000

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component File: cabc6d81-027.pdf

Alternate Text for Visual Component

WCROC farm site with proposed solar array location and pictures of proposed solar design with custom designed electric fence brackets....

Supplemental Attachments

Capital Project Questionnaire, Budget Supplements, Support Letter, Photos, Media, Other

Title	File
Letter of Authorization to Submit	7a6cba87-94c.pdf
Audit	<u>dc8f81d8-94f.pdf</u>

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?

N/A

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

Yes

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

Yes

- Do you wish to request reinvestment of any revenues into your project instead of returning revenue to the ENRTF? No
- Does your project include original, hypothesis-driven research?

Yes

Does the organization have a fiscal agent for this project?

Yes, Sponsored Projects Administration

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")?

No

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

Wendy Moylan and Brad Heins, University of Minnesota

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

Yes, I understand