Environment and Natural Resources Trust Fund

2026 Request for Proposal

General Information

Proposal ID: 2026-404

Proposal Title: AI, EVs, Crypto: Reducing Pollution from Electricity Demand

Project Manager Information

Name: Dylan Millet

Organization: U of MN - College of Food, Agricultural and Natural Resource Sciences

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Project Basic Information

Project Summary: We will provide crucial data to reveal how rising electrical demand will affect Minnesota air quality, and compare the environmental costs and benefits of different approaches for meeting that demand.

ENRTF Funds Requested: $382,000

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?

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.

Air pollution causes over 60,000 deaths/year nationwide, and is the second-highest environmental risk factor for premature death in Minnesota after extreme temperatures. Air pollution also degrades quality of life for those with asthma and allergies, and harms recreational tourism and agricultural crop production. Power generation is a key emission source contributing to air pollution. Minnesota's Renewable Energy Standard aims for 100% carbon-free electricity by 2040, but this goal is challenged by the 35% increase in regional electrical demand projected over that time. The two primary factors behind this growth are 1) data center expansion, and 2) electric vehicle (EV) adoption. Data centers currently planned for MN to support artificial intelligence, crypto-mining, and other high-intensity computing could consume as much power as all households statewide. Meanwhile, EVs were just 1% of MN-registered light-duty vehicles in 2023, but MnDOT has a goal of 65% by 2040. EVs do not have tailpipe emissions, but do cause pollutant emissions elsewhere–emissions that depend on how and where their electricity is generated.

There is a need to determine how these expanding technologies will affect Minnesota air pollution and greenhouse gas emissions, and for policy-relevant comparisons of different options for meeting rising electricity demand.

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.

Research is needed to address the following questions:
1) How will rising electricity demand tied to data centers, EV use, and other electrification initiatives affect Minnesota's air pollutant and greenhouse gas emissions?
2) How do different scenarios for meeting that power demand compare in terms of their air pollution impacts, climate effects, and human health costs?

Our project will address these core questions. We will develop a suite of pollutant emission scenarios reflecting plausible future grid configurations, quantify the resulting greenhouse gas sources, and employ state-of-the-art atmospheric modeling to determine the air quality impacts of each scenario as a function of location across Minnesota. For example, vehicle electrification decreases near-roadway pollutant exposure, but in some cases higher power plant emissions increase pollutant exposure elsewhere. We will quantify these effects and use standard economic approaches to monetize them. In this way the environmental and health outcomes of each scenario can be weighed against its economic benefits or costs.

Overall, the results will provide guidance to support pollution-informed decision-making in the changing electricity landscape of Minnesota.

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?

Results from this project will:
-Determine the air pollution and greenhouse gas impacts of different approaches for meeting Minnesota's rising electricity needs.
-Assess how pollution outcomes vary across the state.
-Monetize these environmental costs so they can be directly weighed against the economic factors in each case.
-Provide concrete information for planning and decision-making that helps conserve Minnesota's air quality while meeting climate goals and future electricity demand.

Activities and Milestones

Activity 1: Define relevant power generation scenarios to meet electricity needs from present-day to 2045.

Activity Budget: $106,000

Activity Description:
Activity 1 will use publicly available information and projections from state, federal, and utility sources to develop a suite of plausible and likely trajectories for Minnesota's electrical demand and associated supply portfolio over the coming 20 years. Scenarios will be designed to encompass high-, mid-, and low-end electrical demand estimates, and, in each case, to span relevant possibilities for fossil and non-fossil contributions to the state's power generation needs. All scenarios will properly account for interstate import/export of electricity, and for each facility's electrical generation capacity, technology, and location–all of which inform pollution generation and its ultimate impact.

The resulting scenarios will then be employed in Activity 2 to construct the pollution emission inventories used for subsequent analyses.

Activity Milestones:

Description	Approximate Completion Date
Define electrical demand scenarios spanning present-day to 2045.	December 31, 2026
Define suite of possible electrical supply portfolios to meet each projected demand scenario.	December 31, 2026
Map the resulting power generation activities spatially and through time to enable source-specific emission computation.	April 30, 2027

Activity 2: Determine air pollutant and greenhouse gas emissions for each scenario.

Activity Budget: $127,000

Activity Description:
We will then use the latest data from the US EPA and MPCA for different types of electricity-generating facilities to compute the overall air pollutant and greenhouse gas emissions that would result from each potential scenario. The air pollutant emission estimates will be chemically-resolved (that is, broken down by individual pollutant types) and will be mapped spatially and through time. This will enable the efforts under Activity 3 to assess impacts for individual chemicals and for different regions of Minnesota.

Activity Milestones:

Description	Approximate Completion Date
Compute total greenhouse-gas emissions for each scenario by year.	August 31, 2027
Compute chemically-resolved air pollutant emissions for each scenario by year.	January 31, 2028
Map pollutant emissions spatially and hourly to enable impact quantification and atmospheric modeling.	April 30, 2028

Activity 3: Map and compare air pollutant outcomes and monetized health damages for key future scenarios.

Activity Budget: $149,000

Activity Description:
Activity 3 will start with atmospheric chemistry modeling to determine the air pollution concentrations that result from key emission scenarios developed under Activity 2. Representative cases will be selected for in-depth analysis that encompass low-, mid-, and high- electricity demand scenarios as well as low-, mid-, and high-carbon generation scenarios. We will use the results to quantify pollution differences relative to present-day, and between the selected scenarios. The scenario-specific model results will then allow us to calculate the human exposure and monetized health damages that result in each case. The modeling domain will encompass the entire state to determine exposure impacts by location and through time.

Overall results from Activity 3 will provide concrete new information to evaluate different approaches for meeting Minnesota's coming electrical needs in terms of their air quality and climate impacts. These monetized damages can then be combined with traditional economic analyses to support informed decision-making and planning.

Activity Milestones:

Description	Approximate Completion Date
Identify representative emission scenarios for in-depth atmospheric modeling.	August 31, 2028
Complete atmospheric model configuration and implementation of scenario-specific emissions.	October 31, 2028
Complete scenario-specific model runs.	January 31, 2029
Compute exposure and health impact assessments. Evaluate and compare impacts between scenarios.	June 30, 2029

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Jason Hill	University of Minnesota	Co-PI	Yes

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?

We will communicate our project's findings through publications and at conferences, by giving presentations open to state and local elected officials, and by discussing results at relevant state agencies including MPCA. We will collaborate with the Minnesota Climate Adaptation Partnership (MCAP) to ensure that outcomes are disseminated to relevant policymakers and stakeholders. All modeling and analysis results will be permanently archived and made publicly available at the Data Repository for the University of Minnesota (DRUM). We anticipate seeking funding for subsequent work in this area from a combination of federal, state, and foundation sources.

Project Manager and Organization Qualifications

Project Manager Name: Dylan Millet

Job Title: Distinguished McKnight University Professor

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

Dr. Dylan Millet is a Professor in the Department of Soil, Water, and Climate at the University of Minnesota. He received his B.Sc. from the University of British Columbia in 1997, his Ph.D. from U.C. Berkeley in 2003, and completed postdoctoral training at Harvard University in 2007. Dr. Millet has been studying air pollution and atmospheric chemistry for over 20 years. He has completed many research projects examining how human-caused and natural emissions affect air quality and climate change. As part of these studies, his research team has successfully used ambient measurements, satellite data, and atmospheric modeling to characterize emissions for a wide range of air pollutants and greenhouse gases across Minnesota.

Dr. Jason Hill is a Professor in the Department of Bioproducts and Biosystems Engineering at the University of Minnesota. He received his A.B. from Harvard College in 1997 and his Ph.D. from the University of Minnesota in 2004. Dr. Hill has been studying the environmental, human health, and climate impacts of energy and natural resource use for over 20 years. As a central part of this work, his group has completed multiple projects using life cycle analysis to compare the environmental tradeoffs of conventional versus alternative energy sources, within Minnesota and beyond.

Dr. Millet and Dr. Hill have worked together on successful grants before, including as project leads in the US-EPA funded Center for Air, Climate and Energy Solutions. If funded, Dr. Millet and Dr. Hill will work together to accomplish the research scope of this project and to co-supervise the project's postdoctoral researcher. They will be responsible for fulfilling project milestones and reporting requirements, and for working with relevant stakeholders to ensure that project findings are broadly and effectively disseminated.

Organization: U of MN - College of Food, Agricultural and Natural Resource Sciences

Organization Description:

The University of Minnesota is one of the largest US universities and offers a rich research and academic infrastructure. PI Millet is in the Department of Soil, Water, and Climate, which has a mission to advance understanding of Earth system processes and the interactions among land, atmosphere, and water. We seek to:

-Improve and protect the quality of soil, air, and water resources in natural and managed ecosystems;
-Enhance agricultural and forest productivity and sustainability;
-Predict and mitigate impacts of environmental change on ecosystems and society; and
-Provide science-based knowledge for improved decision making and a better-informed citizenry.

Co-PI Hill is in the Department of Bioproducts and Biosystems Engineering, which has a mission to develop solutions for the sustainable use of renewable resources and the enhancement of the environment. We discover innovative solutions to advance sustainable production and consumption of energy, food, feed, fiber, materials, and chemicals through engineering, science, technology, and management.
Research will also make use of the University of Minnesota Supercomputing Institute (MSI), which provides extensive software options and an array of high-performance computing systems.
Through the above UMN resources, our team has access to all of the tools needed to successfully complete this project.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Dylan Millet, PI		Overall project leadership. Responsible for scientific, management, and personnel decisions and for ensuring project progress. Analysis design, modeling configuration, data interpretation. Co-supervision of postdoctoral researcher.			36.6%	0.24		$62,603
Jason Hill, Co-PI		Project co-lead. Scientific engagement through all aspects of the proposed work. Expertise in energy system analysis and modeling. Analysis design, modeling configuration, data interpretation. Co-supervision of postdoctoral researcher.			36.6%	0.24		$60,558
Postdoctoral Researcher		A postdoctoral researcher will work full-time on this project. They will carry out the electricity scenario analyses and perform the atmospheric modeling tasks. They will analyze project results, under the supervision of PI Millet and Co-PI Hill, to determine outcomes.			25.9%	3		$252,944
							Sub Total	**$376,105**
Contracts and Services								
Minnesota Supercomputing Institute	Internal services or fees (uncommon)	Data storage fees on supercomputer to enable the atmospheric modeling performed for this project.				0		$2,895
							Sub Total	**$2,895**
Equipment, Tools, and Supplies								
							Sub Total	**-**
Capital Expenditures								
							Sub Total	**-**

Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
							Sub Total	**-**
Travel Outside Minnesota								
							Sub Total	**-**
Printing and Publication								
	Publication	Publication of scientific findings in open-access journals	We will publish our findings in open-access journals to enable broad public dissemination of project results.					$3,000
							Sub Total	**$3,000**
Other Expenses								
							Sub Total	**-**
							Grand Total	**$382,000**

Classified Staff or Generally Ineligible Expenses

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

Non ENRTF Funds

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

Total Project Cost: $382,000

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: 60ad2679-d6c.pdf

Alternate Text for Visual Component

The figure contains 4 panels.
1-Air pollution is a major cause of premature death in MN.
2-Power generation is an important contributor to MN air pollution.
3-Electricity demand will rise sharply in coming years.
4-Our research determines how this rising demand will affect MN air pollution and greenhouse gases....

Supplemental Attachments

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

Title	File
UMN Endorsement Letter	2589c47c-9e6.pdf

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?

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?

Yes

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")?

No

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

Prof. Dylan Millet, Prof. Jason Hill, Sue Kilber (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

N/A