

**Environment and Natural Resources Trust Fund
2014 Request for Proposals (RFP)**

Project Title:

ENRTF ID: 139-E

Eliminating Sulfur from On-Farm Anaerobic Digester Emissions

Category: E. Air Quality, Climate Change, and Renewable Energy

Total Project Budget: \$ 300,000

Proposed Project Time Period for the Funding Requested: 3 Years, July 2014 - June 2017

Summary:

On-farm anaerobic digestion diverts feedlot water from groundwater and mitigates greenhouse gas emissions. Reducing sulfur emissions will further improve environmental and cash-flow benefits allowing for more acceptance of the technology.

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Sponsoring Organization: MN Department of Agriculture

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Location

Region: Statewide

County Name: Statewide

City / Township:

_____ Funding Priorities	_____ Multiple Benefits	_____ Outcomes	_____ Knowledge Base
_____ Extent of Impact	_____ Innovation	_____ Scientific/Tech Basis	_____ Urgency
_____ Capacity Readiness	_____ Leverage	_____ Employment	_____ TOTAL _____%



PROJECT TITLE: Eliminating sulfur from on-farm anaerobic digester emissions.

I. PROJECT STATEMENT

On-farm anaerobic digestion is not a new technology, and currently is installed and operational on six dairy farms in Minnesota. The Minnesota Department of Agriculture would like to offer money for a grant to demonstrate a technology innovation that reduces sulfur emissions. Funds would be used for the gas scrubbing technology, installation, operational costs, and labor. Such technologies, when unproven, find difficulty in gaining acceptance in the marketplace without a documented demonstration of capabilities from an independent party – hence the need for this project.

Currently hydrogen sulfide content in biogas produced during on-farm anaerobic digestion causes corrosion in infrastructure and engines and that are used to produce electricity. Engines used to generate electricity are warranted for up to 800 parts per million hydrogen sulfide content, but digester biogas typically contains around 4,000 parts per million. One new technology, a biological removal system that use bacteria that digest hydrogen sulfide and converts it to elemental sulfur, also promises to lower operating costs because there are fewer inputs for operation. Lower costs would allow for lower electrical price during down markets, which in turn would increase the adoption of anaerobic digestion technology

. Engines produce emissions of sulfur oxides during the combustion process - in a large enough volume in three of our six on-farm systems that a permit from the Minnesota Pollution Control Agency is required. Reduction of these emissions would improve air quality and again reduce costs for larger farms by eliminating the need for a permit.

The Minnesota Department of Agriculture would like to offer the money obtained from the environmental trust fund for a grantee to construct a gas cleanup demonstration project on an existing site.

We would aim to achieve the following goals:

(1) **Greenhouse Gas Mitigation Measurement:** document the greenhouse gas mitigation achieved using anaerobic digestion in these settings over the time of the project, and compare this with what the improvement would be over operating a non-anaerobic digestion manure management operation of various widespread methods;

(2) **Reduce Sulfur Emissions:** drastically reduce sulfur oxides produced in the electricity-producing combustion process; and

(3) **Reduce Operating and Maintenance Costs:** reduce operating costs for on-farm anaerobic digestion operation – specifically reducing the ongoing maintenance due to corrosive hydrogen sulfide related costs. This goal would enable Minnesota Department of Agriculture to genuinely promote anaerobic digestion. More accepted implementation anaerobic digestion would achieve greater greenhouse gas mitigation goals.

The project will focus on the accumulation of both baseline data and data from project implementation.

II. DESCRIPTION OF PROJECT ACTIVITIES

Activity 1: Initiate project - receive baseline data from projects

Budget: \$50,000

The project must be initiated with a request for proposals and site selection. Before equipment installation, data must be collected to be used to compare with results after installation of gas cleanup technology. Data will be collected regarding sulfur emitted, operational expenses, along with electricity generated and methane emissions mitigated using anaerobic digestion.

Outcome	Completion Date
1. Write and issue request for proposals for biogas cleanup project	9-2014
2. Review applications/choose a project for funding	11-2014



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3. Collect baseline data from projects for period of 6 months to 1 year	11-2015
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Activity 2: Install gas cleanup project hardware at the project site.

Budget: \$250,000

Technology used specifically for gas cleanup will be installed on the site of the project. Money will be used for the equipment, shipping and labor costs.

Outcome	Completion Date
1. Install gas cleanup project on one of the current locations of Minnesota’s 4 on-farm anaerobic digestion owners	6-2016
2. Begin to collect data as in activity 1 once the system again arrives at steady-state operation for operation with clean gas with new technology.	7-2017

Activity 3: Collect project data from site; review data; summarize findings.

Budget: \$50,000

Identical data to the baseline data will be collected with the cleanup technology operating. Data will be compiled and analyzed into a report.

Outcome	Completion Date
1. Receive project data from projects	5-2017
2. Review data; summarize findings	6-2017

III. PROJECT STRATEGY

A. Project Team/Partners

Minnesota Department of Agriculture/Kevin Hennessy – no funds.

Minnesota Pollution Control Agency – no funds.

U.S. Environmental Protection Agency-Agstar – No funds.

Farm chosen for site of demonstration project - \$300,000.

B. Timeline Requirements

All three years are requested due to the unpredictable nature of renewable energy projects, where the unexpected can often be the rule.

C. Long-Term Strategy and Future Funding Needs

Although success is sought from this single three-year project, there are always improving technologies available which may also be in need of demonstration before full commercialization can be initiated. The hope in this project is to quantify not only improvement from promising technology, but to show the overall worth in using farm digestion as a manure management method that achieves the best results in regards to greenhouse gas mitigation compared to other manure management methods.

2014 Detailed Project Budget

Project Title: Eliminating sulfur from on-farm anaerobic digester emissions.

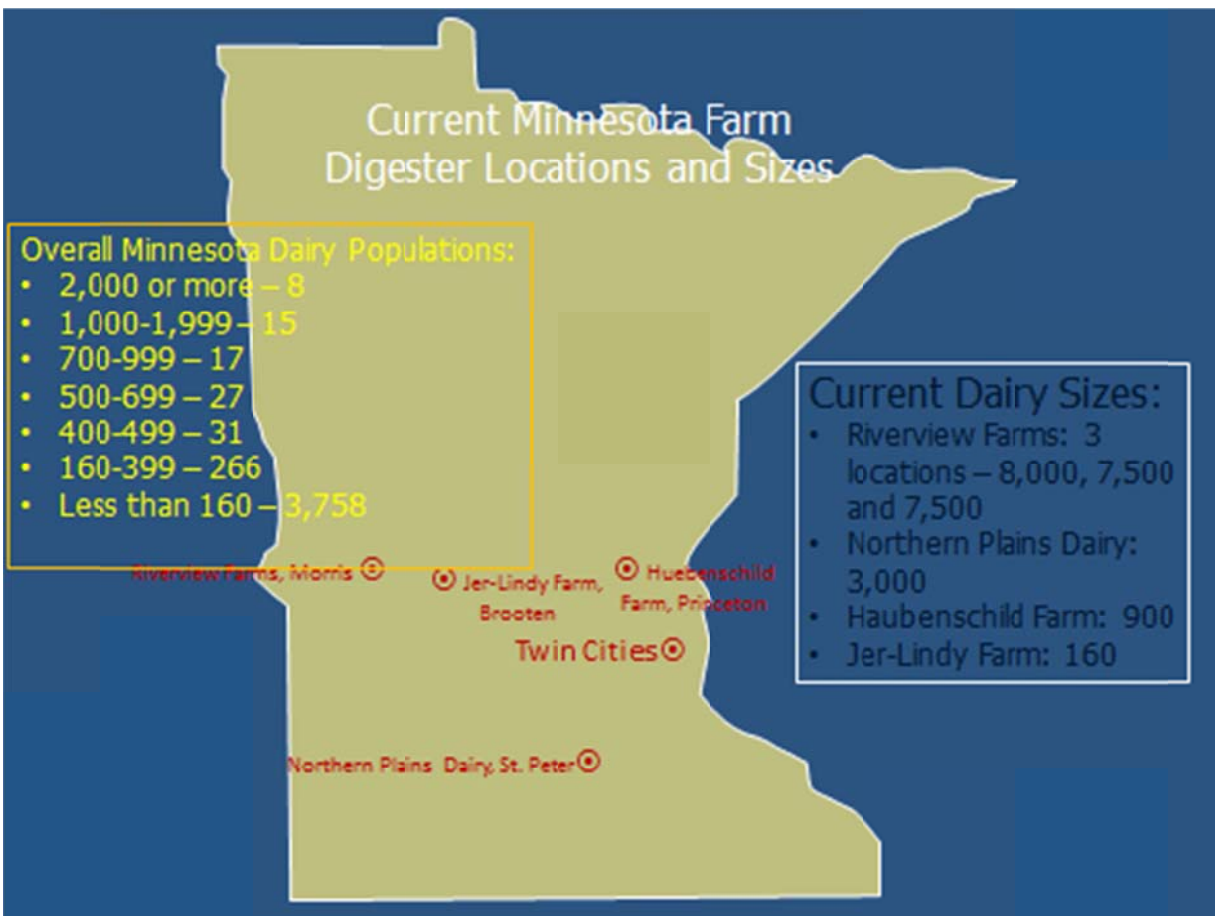
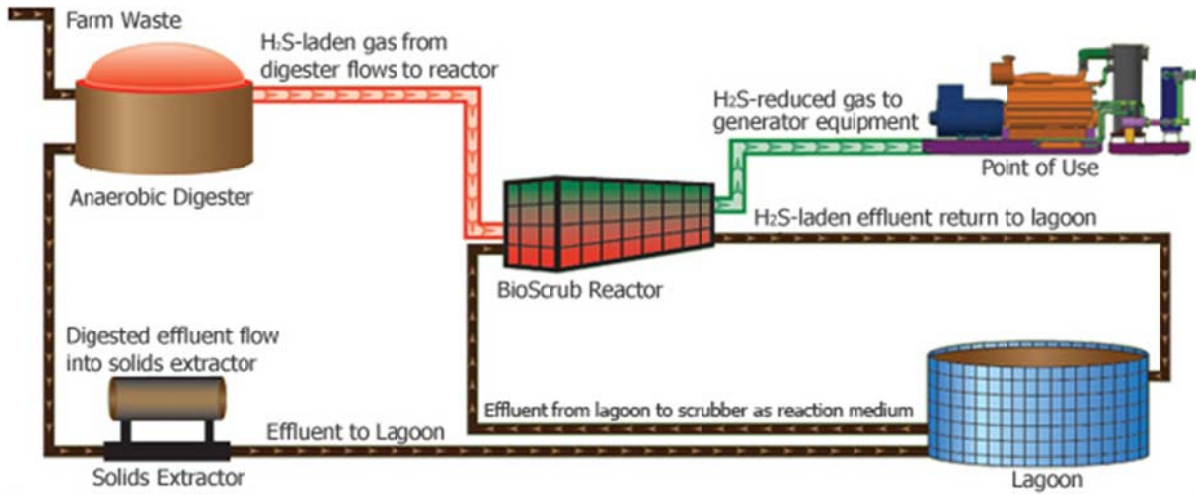
IV. TOTAL ENRTF REQUEST BUDGET [3] years

<u>BUDGET ITEM</u>	<u>AMOUNT</u>
Contracts: <i>Contracts will be made with the Minnesota Department of Agriculture and the farm that will house the project. Subcontracting of the project tasks will be done by the farm. The contracts will be executed as our contracts through the NextGen Energy Grant program are currently.</i>	\$ 300,000
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =	\$ 300,000

V. OTHER FUNDS

<u>SOURCE OF FUNDS</u>	<u>AMOUNT</u>	<u>Status</u>
Other Non-State \$ Being Applied to Project During Project Period: <i>EPA-Agstar</i>	\$ 50,000	<i>Pending</i>
Other State \$ Being Applied to Project During Project Period: <i>None</i>	\$ -	
In-kind Services During Project Period: <i>Minnesota Department of Agriculture will be managing the grants that would be made available with these funds. These grants would be managed by the same person who currently manages the NextGen Energy grants and would be managed in the same manner of oversight (which includes regular sight visits). Data compilation at projects end would also be done by the MDA.</i>	\$ -	<i>Secured</i>
Remaining \$ from Current ENRTF Appropriation (if applicable): <i>N/A</i>	\$ -	
Funding History: <i>None</i>	\$ -	

Energy Cube process diagram (submitted bids for 4 different sized systems)



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MINNESOTA DEPARTMENT OF AGRICULTURE MISSION:

“Our mission is to enhance Minnesotan’s quality of life by ensuring the integrity of our food supply, the health of our environment, and the strength of our agricultural economy.”

WORK HISTORY AND APPLICABLE EXPERIENCE:

Minnesota Department of Agriculture, Saint Paul, Minnesota; December, 2011 to present.

Job Title: Biofuels Specialist

Applicable experience:

- Assist in collaboration with industry, government, and the public with regards to Minnesota biofuel issues.
- Administrator-NextGen Energy Grant Program.

Agricultural Utilization Research Institute, Waseca, Minnesota; December, 2008 to December, 2011.

Job title: Associate Scientist

Applicable experience:

- Provide scientific product development and pilot lab services to facilitate technology transfer and applied research for value-added co-Products and commodity side streams to clients and in support of AURI initiatives.
- Provide guidance and counsel in scientific development and utilization of agricultural products and co-products in new or expanding market opportunities.
- Specifically, 80-90% of time spent developing and/or modifying existing methodologies.
- 40-50% of time specifically spent testing biogas systems using prototype bench scale technology that mimicked Minnesota systems.

University of Minnesota, St. Paul, Minnesota; January, 2006 to December, 2008.

Job Title: Graduate Assistant

Applicable experience:

- Project management/process development.
- Equipment purchasing decisions and implementation of purchased equipment.
- Design and implementation of experiments; reporting and analysis of results in written reports, posters and PowerPoint presentations.
- Developed expertise in high pressure/high temperature liquefaction of biomass (thesis topic).
- Troubleshooting and repair of project team equipment as required - outstanding use of manufacturer’s support services.
- Graduated with Master of Science degree in Biosystems and Agricultural Engineering.

Other Accomplishments of Note:

- Obtained Engineer in Training Certification by passing national exam, December 2011.
- Authored the public initiative “Investigating Drying Technologies for Post-Digester Manure Solids” - <http://auri.org/research-article.php?raid=66>.
- Co-authored public initiative “Microwave Drying of Beet Pulp” - <http://www.auri.org/research-article.php?raid=33>.
- Constructed biogas testing lab (see YouTube video: <http://www.youtube.com/watch?v=CylUH8wqIQg>).
- Developed numerous computer programs, both stand-alone and Visual Basic Applications for Microsoft Excel, for various lab applications.