

**Environment and Natural Resources Trust Fund
2020 Request for Proposals (RFP)**

Project Title:

ENRTF ID: 201-EH

Identifying Agricultural Energy Consumption and Impacts in Minnesota

Category: H. Proposals seeking \$200,000 or less in funding

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

Total Project Budget: \$ 146,791

Proposed Project Time Period for the Funding Requested: June 30, 2022 (2 yrs)

Summary:

This project uses data from multiple sources to analyze current and future agricultural energy use at the county and enterprise levels, filling a key knowledge gap for making system-wide improvements.

Name: Joel Tallaksen

Sponsoring Organization: U of MN

Job Title: Dr.

Department: West Central Research and Outreach Center

Address: 46352 State Highway 329
Morris MN 56267

Telephone Number: (320) 589-1711

Email tall0007@umn.edu

Web Address: _____

Location:

Region: Statewide

County Name: Statewide

City / Township:

Alternate Text for Visual:

Figure 1 is a map showing the value of agriculture by county to provide the scale of agriculture. Figure 2 shows the change in electricity sources over the last decade.

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



PROJECT TITLE: Identifying Agricultural Energy Consumption and Impacts in Minnesota

I. PROJECT STATEMENT

Minnesota farms provide an abundance of food and economic opportunities for the citizens of the state, with on-farm production of crops and livestock valued at over \$20 billion annually (USDA-NASS). These products help drive the state's large food manufacturing sector, which brings the total economic activity for agriculture in Minnesota to \$121 billion per year (MN Dept. of Ag). Among the most important inputs needed to make this level of agricultural production possible is energy resources. Over the last decade, the feasibility of a number of new agricultural technologies, renewable energy production systems, and conservation measures have been studied to the point that they are ready to begin deployed on Minnesota's farms. However, a lack of knowledge about agricultural energy use in the state is limiting potential adoptions of these technologies.

This project will use several data sources to develop up-to-date energy models that can overcome this energy information gap for Minnesota. The *primary objective of the project is to generate county level energy use maps* that identify farming activities within counties and the energy use associated with those activities. This work will also provide average energy use information for the different farming enterprises in the state (i.e. cropping, dairy, or swine). A *second objective for the project is to identify areas where technological advances will enhance the sustainability and economics of Minnesota's agricultural production*. In addition to the farm base solutions such as renewable energy sources and conservation, there will likely be changes in the state's electricity grid that will influence the economics and sustainability of agricultural production. Modeling will analyze how these changes alter fossil energy use and the related sustainability impacts on agricultural commodities. *The final objective is to produce a concise set of information on Minnesota's agricultural energy use that is available to stakeholders, policy-makers, citizens, and researchers*. This project has a two year timeline for the data collection and analysis proposed. *The broader goal of this effort is to foster development of renewable energy and energy conservation projects that will help maintain the environmental sustainability and economic competitiveness of Minnesota's agricultural sector*.

The need for this information was recognized while our staff at the West Central Research and Outreach Center worked with Morris Community-Climate Smart Municipalities working group to determine how to meet a county-wide strategic goal of producing 80% of energy consumed in the county as well as reducing energy consumption by 30%. Unfortunately, very little specific information was found to indicate how much energy regional farmers are using and what activities are responsible for most of that energy use. The best estimates made for the Stevens County project indicate that agricultural energy is a much larger component of county-wide energy use than that used in cities and small towns.

Accomplishing energy reduction goals will rely on a combination of community energy production, such as solar and wind energy, and reductions in energy using new lighting, heating, cooling, and ventilation systems. Similarly, precision cropping equipment can allow farmers to reduce agronomic inputs and tractor fuel use for cropping systems and other research is examining renewably-produced cropping inputs made in Minnesota, such as nitrogen fertilizer. The current lack of data limits our ability to predict economic benefits, engage the farmers who would benefit most from updated technologies, or estimate how Minnesota's statewide agricultures environmental and economic footprints could be improved. Farmers and businesses need to have reliable energy use information before they will make investments or changes to their operations.

The significant consumption of fossil-based energy in agriculture has led to a perception among some that current agriculture production is not sustainable. While producers may or may not be concerned with the impacts of energy use on the environment, they should be aware of this perception and that it can impact consumer willingness to purchase their products. In addition, other nations and states are beginning to use sustainability measures to evaluate agricultural products and assign regulatory rules, tax credits, or economic values to them. The most well know example of this is the California regulations covering import of ethanol into the state, which limits ethanol tax credit values based on fossil energy needed for production and transport.

The costs of these fossil energy inputs has a direct impact on farmer's incomes and Minnesota's economy. Without significant energy natural resources, much of the energy consumed and crude oil-based inputs used in



**Environment and Natural Resources Trust Fund (ENRTF)
2020 Main Proposal**

Minnesota must be imported into the state at significant cost. One example is the roughly \$400 million that Minnesota farmers spent to apply the 800,000 tons of anhydrous ammonia fertilizer used yearly. Likewise, livestock operations are heavily impacted by propane and electricity demands for building heating and cooling. Minnesota is also at the end of the supply chain for several agricultural inputs and occasionally experiences shortages which either drive up input prices, cause rationing, or force farmers to do without. For these reasons, Minnesota’s agricultural community has a need to move towards a less fossil-energy intense future.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1 Title: Collection and Analysis of Current Agricultural Energy Data

Description: This activity brings together data from different sources to evaluated farm energy use at the county and farm level to form a more accurate picture of energy use in agriculture across. Specifically, USDA-National Agricultural Statistics Service (NASS) and the U of M Dept. of Applied Economics information would be included as they are well documented and collected at regular intervals. Existing state and national farm surveys provide reliable details about the size, scope, and operations of farms in different regions of the state. Information about the energy use for specific agricultural activities can be found in scientific literature and within the USDA- Data Commons, which is the USDA’s central repository for research information. This work will also provide average energy use information for the different farming enterprises in the state (i.e. cropping, dairy, or swine).

ENRTF BUDGET: \$58,716

Outcome	Completion Date
1. <i>Collect Minnesota Agricultural Demographic Data</i>	3/31/21
2. <i>Identify Energy usage by agricultural enterprise for major agricultural activities</i>	4/31/21
3. <i>Compile county and state totals for energy use</i>	5/31/21

Activity 2 Title: Modeling Energy Savings and Future Energy Use Scenarios

Description: This activity uses energy data, pricing information, and energy use reductions to evaluate potential energy and economic savings to Minnesota’s agricultural community, as well as sustainability improvements. An important component of this modeling will be an analysis of fossil energy use and the related sustainability impacts of agricultural commodities.

ENRTF BUDGET: \$58,716

Outcome	Completion Date
1. <i>Develop county level data on impacts of MN energy mix changes to agriculture</i>	12/31/21
2. <i>Develop county level data on potential energy reduction/sustainability improvements</i>	2/1/22

Activity 3 Title: Outreach and Information Dissemination

Description: The information generated will be developed into outreach documents to reach several different audiences via online and print formats, as well as presentations at regional meetings. The agricultural community and agricultural policy makers would be provided a brief report summarizing where technologies would best help them reduce energy use and related costs. Infographics would be designed to convey important findings to stakeholders in handouts and online. A complete final report and data set would be available on our website and be submitted to the USDA National Agricultural Library Data Commons, for access by other researchers.

ENRTF BUDGET: \$29,358

Outcome	Completion Date
1. <i>Infographics developed to present important findings</i>	3/31/22
2. <i>Brief summary of findings written</i>	4/30/22
3. <i>Full research report finished and data published in print and online</i>	6/30/22

III. PROJECT PARTNERS AND COLLABORATORS: The project will rely on stakeholder input, but will not have formal additional partners or collaborators.

IV. LONG-TERM IMPLEMENTATION AND FUNDING: It is intended that this work will assist others in their implementation of energy saving, thus further funding requests is not anticipated.

Attachment A: Project Budget Spreadsheet

Environment and Natural Resources Trust Fund

M.L. 2020 Budget Spreadsheet

Legal Citation:

Project Manager: Joel Tallaksen

Project Title: Identifying Agricultural Energy Consumption and Impacts in Minnesota

Organization: University of Minnesota, WCROC

Project Budget: \$146,791

Project Length and Completion Date: 2 Years (6/30/2020)

Today's Date: 4/15/19



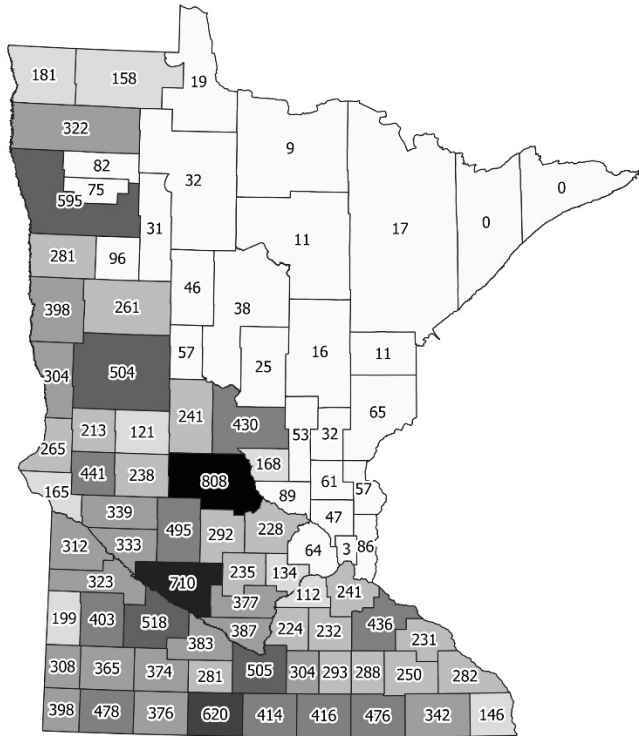
ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Budget	Amount Spent	Balance
BUDGET ITEM			
Personnel (Wages and Benefits)	\$ -	\$ -	\$ -
<i>Lead Researcher, \$121,564 (73% Salary, 27% Fringe [36% fringe rate]), 2 years at 80%FTE [This position is a soft-funded position and is reliant on external research dollars (i.e. the University of Minnesota does not support the position with recurring funds)]</i>	\$ 138,791		
Professional/Technical/Service Contracts			
Equipment/Tools/Supplies			
<i>Supplies for disseminating and storing data.</i>	\$ 400		
<i>Specialized software and database updates (Note: This software and the databases it uses are specialized for tracking energy and environmental impacts in complex systems.)</i>	\$ 3,000	\$ -	
Capital Expenditures Over \$5,000			
Fee Title Acquisition			
Easement Acquisition			
Professional Services for Acquisition			
Printing & Mailing	\$ 3,000		
Travel expenses in Minnesota			
<i>Travel to meet with stakeholders and professionals within state. Estimate 5 trips at 350 miles.</i>	\$ 1,600		
Other			
	\$ -	\$ -	\$ -
COLUMN TOTAL	\$ 146,791	\$ -	\$ -

SOURCE AND USE OF OTHER FUNDS CONTRIBUTED TO THE PROJECT	Status	Amount	Spent	Balance
Non-State:				
State:				
<i>In kind: The University of Minnesota is forgoing the typical 54% federally negotiated indirect cost recovery normally associated with research grants. This funding covers facilities, support staff, and other University activities that are not directly part of the research, but must be present to support research activities.</i>		\$ 79,267		
Other ENRTF APPROPRIATIONS AWARDED IN THE LAST SIX YEARS	Amount legally obligated but not yet spent	Budget	Spent	Balance
<i>Life Cycle Energy of Renewably Produced Nitrogen Fertilizers M.L. 2014, Chp. 226, Sec. 2, Subd. 08e</i>		\$ 250,000	\$ 250,000	\$ -



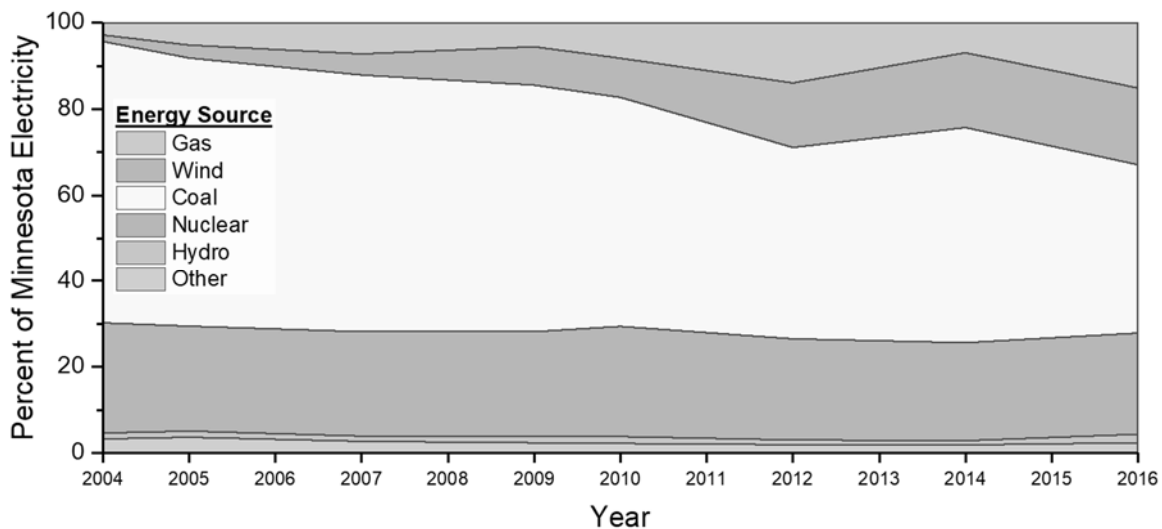
B. Visual Component or Map

Value of Minnesota's Agriculture



Minnesota's sales of agricultural crops and livestock by county. The number on each county represents the sales per year in millions of dollars from that county. Combined, Minnesota farmers brought over \$20 Billion worth of products to market. Just for illustrative purposes, if 15% of the value of the sales were direct energy expense (electricity, fuel, propane), that would be \$3 billion paid by farmers for their energy. Much of which would be leaving the state to regions of the country with fossil resources or other countries that produce agricultural inputs with fossil resources. Based on USDA data from the national 2012 farm census.

Minnesota's Changing Energy Landscape



The mix of electricity production in Minnesota's electrical grid. In terms of reducing Minnesota's dependence on imported fossil based energy, the electrical grid is probably the easiest and most far along in adopting changes that will benefit Minnesota's agricultural community. Solar and wind production both provide income to rural areas and reduce the amount of money leaving the state to purchase fossil energy.



F. Project Manager Qualifications and Organization Description

Project Manager:

Joel Tallaksen, Renewable Energy Scientist
West Central research and Outreach Center
University of Minnesota
Morris, MN 56267

Background: My current research is focused on agricultural production, energy use, and energy systems, with a focus on improving environmental sustainability in agriculture. I am using life-cycle analysis (LCA) as a tool to determine the amount of energy needed and greenhouse gases emitted in a variety of livestock and cropping systems. My goal is to reduce or optimize energy use in farm production to create systems that are very productive, but use less fossil energy resources. However, the optimization doesn't simply focus on enhancing energy use, but also considers sustainable harvesting/soil health and economic.

Recent Grant Funded Activity: (Project title, funding agency, and funds awarded)

Breaking barriers to organic swine transition: Utilizing cover crops as feed ingredients to reduce feed cost. USDA-NIFA \$500,000

Host meetings and visit organic swine systems to examine, discuss, and summarize the initial barriers to wider adoption of organic swine production. USDA-NIFA \$50,000

Evaluate different energy sources for renewable ammonia fertilizer production using life cycle methods. LCCMR \$250,000

Integration of renewable and efficient energy technologies to green energy consumed in agricultural production systems- U of M IREE- \$350,000

Sustainable nitrogen fertilizers based on renewable resources- Swedish Energy Agency- \$40,000

Organization Description: The University of Minnesota is a world class educational and research institution with campuses and research centers throughout the state. The combination of exceptional faculty and staff knowledge with the latest in research facilities and equipment gives the University of Minnesota the ability to consistently conduct ground-breaking research.