

**Environment and Natural Resources Trust Fund
2017 Request for Proposals (RFP)**

Project Title:

ENRTF ID: 151-E

Renewable Energy Production from Municipal Organic Waste

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

Total Project Budget: \$ 1,687,500

Proposed Project Time Period for the Funding Requested: 3 years, July 2017 - June 2020

Summary:

Renewable energy production fueled by municipal organic will reduce landfill waste and provide electrical power for 25 homes and reduce pollution while being a site for undergraduate and faculty research.

Name: Melanie Waite-Altringer

Sponsoring Organization: Minnesota Energy Center (MNEC)

Address: 11200 Mississippi Blvd NW
Coon Rapids MN 55433

Telephone Number: (763) 226-8963

Email melanie.waite-altringer@anokaramsey.edu

Web Address _____

Location

Region: Statewide

County Name: Statewide

City / Township:

Alternate Text for Visual:

Visual displays photos of the anaerobic digester system, its location, and a table of its energy output.

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



PROJECT TITLE: Renewable Energy Production from Municipal Organic Waste

I. PROJECT STATEMENT

This project will demonstrate the use of a city located, anaerobic digester (AD) as a sustainable and renewable energy source using organic waste from K-16 schools and local homes as the fuel. The 34kW EUCOLino AD system will reduce potential landfill waste by 1,000–4,000 tons annually and it will produce 241,414kWh/year of electrical power or the equivalent usage of over 25 average MN homes. The thermal power produced will be 163,252 btu/year and will heat the adjacent greenhouse used for various forms of plant production studies by faculty and students and will utilize the nutrient rich effluent produced for soil amendment purposes. The greenhouse will showcase the complete cycle of life that this system is a part of: living matter to waste to living matter again. Capturing the strong greenhouse gas, methane, produced from this natural process and utilizing it for electrical and thermal power production will help reduce Minnesota’s greenhouse gas emissions. Minnesota Energy Center (MNEC) partners’ College faculty members and undergraduates will research proper percentages of the combination of inputs consisting of household organic waste, K-12 school food waste, College organic waste, and community yard waste that will create the greatest amount of methane. Collecting organic waste from educational facilities will allow this project to be an everyday, intimate part of many students’ lives and will educate them on why Minnesota needs such systems in place to help our environment’s water and air quality. The faculty involved in the research will be from a wide variety of MNSCU Colleges and STEM departments including Biology, Chemistry, Environmental Science, Math, and Renewable Energy Systems/Programs. Partners for the project include MNEC Colleges, City of Elk River, Great River Energy, Elk River Municipal Utilities, and Waste Management, Inc. The AD system will reside within the Elk River City limits, at the local landfill operated by Waste Management, Inc.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: Construction of an AD system at the Elk River landfill site for electrical power, thermal power, and compost production. **Budget: \$1.393 million**

Complete installation of the 34kW EUCOLino AD system made by BIOFerm Energy Systems for renewable electrical and thermal energy power production and a screwpress for processing effluent to extract solids for compost usage.

Outcome	Completion Date
<i>1. Complete installation of AD system and connection to a main power distributor for yearly output of 241,414kWh of electrical energy and 163,252 btu’s of thermal power</i>	<i>January 2018</i>

Activity 2: Research the best possible combination of organic waste for the greatest amount of methane and power produced. **Budget: \$194,500**

MNEC partners’ College faculty and undergraduate research students will determine the best percentages of organic waste, from various sources, and yard waste combinations to produce the greatest amount of methane at different times of the year.

Outcome	Completion Date
<i>1. Analysis of varied organic waste input combinations from different sources used as the AD system fuel source including K-12, College, and household organic waste and yard waste for best AD system performance</i>	<i>June 2020</i>
<i>2. Analysis of methane gas, electrical power, and thermal energy production</i>	<i>June 2020</i>
<i>3. Analysis of overall feedstock costs – capital and operating</i>	<i>June 2020</i>
<i>4. Determine best use of energy at peak shave & to offset other renewable energy sources</i>	<i>June 2020</i>



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Activity 3: Greenhouse construction for demonstration of full energy process and research of proper compost usage.

Budget: \$100,000

MNEC partners' College faculty and research students will utilize a small greenhouse as a showcase for the general public to visualize the complete energy circle that this process entails: Living organic matter-to waste-to energy-to nutrients for living organic matter (circle of life). Organic effluent usage research will also occur within the greenhouse.

Outcome	Completion Date
<i>1. Small greenhouse constructed adjacent to the AD system using thermal energy produced from the AD system for greenhouse temperature control</i>	<i>March 2018</i>
<i>2. Research use of the effluent from the AD system as a soil amendment for the greenhouse plants including bi-weekly nutrient and composition checks</i>	<i>January 2020</i>
<i>3. Use greenhouse used as teaching tool for students and general public to understand the energy cycle that this project displays</i>	<i>January 2020</i>

III. PROJECT STRATEGY

A. Project Team/Partners

Project Partners Receiving Funds:

- Melanie Waite-Altringer (\$135,000): Principal Investigator of project-main researcher onsite & biology faculty at Anoka-Ramsey Community College (ARCC) total pay includes fringe benefits not paid to PI
- Steve Knight (\$15,000): Project consultant-assist in obtaining permits and oversee proper construction of the AD system and greenhouse, ARCC's Owner's representative on its' construction projects
- Rose Patzer (\$25,000): MN West Community College biofuel faculty assisting with research and data analysis - total amount includes fringe benefits not directly paid to faculty
- Undergraduate research students (\$18,000): students completing and assistance in research
- Bruce Peterson, MNEC Director (\$35,000) Administrative Project Coordinator

Project Partners not receiving funds:

- Jim Hamann, Waste Management, Inc., Sr. District Manager Northern Minnesota
- Kristin Mroz, City of Elk River, Environmental Technician
- Matthew Herman, Great River Energy, Great River Energy Resource Processing Plant Manager
- Tom Sagstetter, Elk River Municipal Utilities, Conservation and Key Accounts Manager

B. Project Impact and Long-Term Strategy

The long-term strategy for the project is to ensure that anaerobic digestion of organic waste from various sources can be utilized as a viable renewable energy source in a metropolitan/city area. Impacts of the project to our environment and community include reducing landfill waste, reducing water and air pollution, and demonstrating the benefits of this process to the general public. Undergraduates from MNEC partners' colleges will be able to complete true scientific research and thereby promote good environmentally-friendly practices to the community, including K-16 students. This specific AD system can be used for electrical and thermal production for many more years after the project is complete. The system can also be expanded to produce more energy and reduce the amount of organic waste in landfills. The City of Elk River and Waste Management, Inc. will maintain the system and MNEC will continue to use it as teaching and research tool for the community and in many courses, including such classes as Environmental Science and Energy Issues. Since the system will create much more electricity than it uses, sale of the excess power will help offset any future system expenses, as well as, potential compost sales and organic waste tipping fees.

C. Timeline Requirements

This project along with its research will require 36 months to complete from July 2017 to June 2020.

2017 Detailed Project Budget

Project Title: Renewable Energy Production from Municipal Organic Waste

IV. TOTAL ENRTF REQUEST BUDGET for 3 year total

BUDGET ITEM	AMOUNT
Personnel:	
Melanie Waite-Altringer, Project Manager and Principal Investigator (61% salary, 39% fringe benefits) ~14 credit FTE	\$ 135,000
Steve Knight, project consultant to assist in obtaining necessary permits and oversee proper construction of anaerobic digester and greenhouse, Owner's Representative on Commercial and Institutional Construction Projects ~8%FTE	\$ 15,000
Rose Patzer, Faculty assisting with data analysis and research (61% salary, 39% fringe benefits) ~2 credit FTE	\$ 25,000
Bruce Peterson, Director MNEC, Administrative Coordinator ~8%FTE	\$ 35,000
Undergraduate Research Assistants, data monitoring, and analysis - STIPEND	\$ 18,000
Professional/Technical/Service Contracts:	
Site Preparation, installation, and electrical hookup including slab for Anaerobic Digester System (TBD): Local professional company	\$ 380,000
Equipment/Tools/Supplies:	
BIOFerm's Energy System's EUColino Anaerobic Digester including screw press for effluent processing for solids separation for compost use	\$ 935,000
Greenhouse equipment and construction for effluent research and community showcasing environmental sustainability	\$ 30,000
Two video cameras for continual viewing of organic waste input & output	\$ 5,000
Greenhouse supplies: pots, soil, seeds, etc. used for research on effluent use and its benefits of the projects sustainability aspect	\$ 5,000
Acquisition (Fee Title or Permanent Easements):	N/A
Travel:	
Mileage (~9000 miles) to and from Anaerobic Digester to data analysis site recruitment of schools & education of project	\$ 4,500
Additional Budget Items:	
Operational costs: maintenance of anaerobic digester equipment, effluent and influent monitoring	\$ 30,000
Operational costs: maintenance of greenhouse	\$ 5,000
Transport of materials to and from waste site	\$ 20,000
Contract administration, establishment of interagency agreements, permit application and administration, and project administration	\$ 40,000
Printing of reports for distribution and onsite signage of project and in area schools & businesses	\$ 5,000
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =	\$ 1,687,500

V. OTHER FUNDS *(This entire section must be filled out. Do not delete rows. Indicate "N/A" if row is not applicable.)*

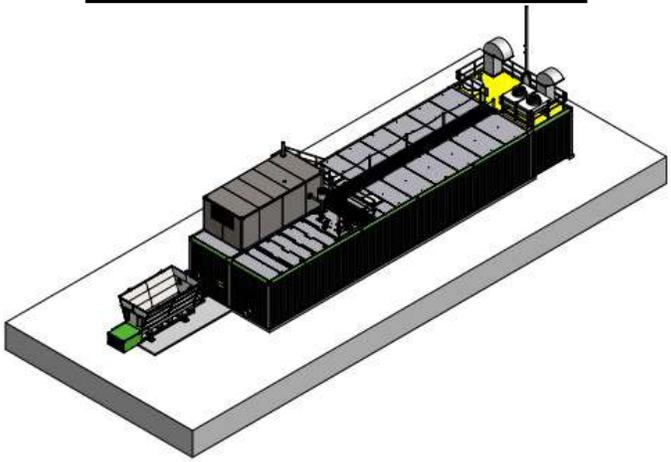
SOURCE OF FUNDS	AMOUNT	Status
Other Non-State \$ To Be Applied To Project During Project Period:	N/A	
Other State \$ To Be Applied To Project During Project Period:	N/A	
In-kind Services To Be Applied To Project During Project Period: <i>City of Elk River will assist by: involving area K-12 schools to participate in project by providing bins for organic waste collection \$5,500, provide additional feedstock (residential single sort organics, community yard waste from compost site, waste water bio-solids), provide employee worktime involvement of \$5,000 by assisting in tours to interested parties regardless of location, as a part of Energy City, assist in developing marketing documents, publicity, and aid in maintaining records. Great River Energy will assist by aiding in environmental permitting and review consulting, may be a potential secondary site host, and a feedstock provider \$10,000.</i>	\$ 18,500	<i>secured</i>
Funding History:	N/A	
Remaining \$ From Current ENRTF Appropriation:	N/A	



 = Potential Anaerobic Digester (AD) location atop the Elk River Landfill - Waste Management, Inc.
Address: 22460 Highway 169 Elk River, MN



Diagram and photos of the 34kW Eucolino Anaerobic Digester



EUCOLINO ENERGY GENERATION & PARAMETERS

Input Assumptions	
Source Separated Organics	1000 - 4,000
K-16 & home food/yard waste	tons/y

Energy Generation	
Biogas Production	5,026,050 (ft ³ /y)
methane content	60%
Methane production	3,015,630 (ft ³ /y)
Combined Heat & Power Unit (CHP)	34kW
Parasitic load (AD & CHP only)	26,825 kWh/y
Electrical Power for Utilization -equivalent usage of 25 homes	241,414 kWh/y
Thermal Power for Utilization	163,252 btu/y
Liquid Digestate - used for compost/soil amendment	850 tons/y





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Project Manager Qualifications and Organization Description

Project Manager: Melanie Waite-Altringer, Biology faculty member at Anoka-Ramsey Community College.

- 1995, Bachelor of Science degree in Biology from St. Cloud State University, St. Cloud MN
- 1997, Masters of Arts degree in Biology from St. Cloud State University, St. Cloud MN
 - Thesis research work title: “Aquatic Insect Trapping and Separating Methods for Wetland Sampling”
- 1997-present, Full-time biology faculty at Anoka-Ramsey Community College teaching a wide variety of biology courses including environmental science and energy issues.
- 2010-present, Research in renewable energy sources with a main emphasis on Biofuel/Biodiesel oil-seed crop production using various techniques in the Anoka-Sandplain and its effects upon beneficial pollinating insects.
- Biodiesel crop production grants awarded for the research through Bayer CropScience, the Initiative Foundation, EverCat Fuels, LLC., and Anoka-Ramsey Community College.
- Helped obtain an \$800,000+ Xcel Energy RDF grant for a 458 kW solar array to be installed on the Coon Rapids campus of Anoka-Ramsey Community College.
- Current and previous research partners have been: USDA-ARS of Morris MN, Bayer CropScience’s canola division and Bee Care Center, EverCat Fuels, LLC., Prairie Restorations, Inc., Federated Co-ops of Isanti MN, and Winfield.
- Worked with and managed undergraduate research students in all of her research projects performed on campus.
- 2012-present, Member of the Minnesota Energy Center
- 2013-present, Member of the Sherburne County Local Water Plan Advisory Board and its Aquatic Invasive Species taskforce.

Organization Description: Minnesota Energy Center (MNEC)

In fall 2012, the Minnesota Energy Center (MNEC) was established to coordinate the activities of the Minnesota Energy Consortium, the partnership of the energy industry professionals and higher education. Currently, MNEC consists of 12 campuses from 10 MnSCU colleges actively engaged in the work of the Center. We continue to develop our programs and redesign where needed to adjust to changing needs of the Minnesota energy industry landscape. The Energy Center continues to lead in program development at the national level and is very engaged with several other states in collaborative activities. (MNEC) is led by Minnesota West Community and Technical College and St. Cloud Technical and Community College. Our primary focus is development of programming to prepare technicians for the energy production industry. Degree programs cover the broad spectrum of energy production technologies including Bio-fuels, Ethanol, Solar, Wind, Fossil Fuels and Nuclear and technician programs in Electrical Linework and Gas Pipeline technologies.

MNEC Activity Hubs -

- Workforce Development: The right education and training to support the energy industry.
- Pipeline: Increased awareness of energy related career opportunities
- Research: Education and industry partnerships that advance research in energy related fields.
- Collaboration at national level with the Center for Energy Workforce Development.