Environment and Natural Resources Trust Fund
2018 Request for Proposals (RFP)

Project Title: **ENRTF ID: 166-E**

Life Cycle Analysis of Anaerobic Digestion and Organics

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

Total Project Budget: $ 250,000

Proposed Project Time Period for the Funding Requested: 3 years, July 2018 to June 2021

Summary:

A life-cycle analysis (LCA) of anaerobic digestion (AD) will evaluate the use of organic materials to create clean energy, conserve resources and reduce the amount of organics going to landfills.

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Location

Region: Statewide

County Name: Statewide

City / Township:

Alternate Text for Visual:

Flow diagram of Life Cycle Analysis study of Anaerobic Digestion

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

PROJECT TITLE: Life Cycle Analysis of Anaerobic Digestion and Organics

A life-cycle analysis (LCA) of anaerobic digestion (AD) will evaluate the use of organic materials to create clean energy, conserve resources and reduce the amount of organics going to landfills. AD is a collection of processes by which microorganisms break down biodegradable material in the absence of oxygen which produces biogas and an organic fraction commonly referred to as digestate. A life cycle analysis evaluates the impacts of a material through all stages of its life including extraction, production, use, and at end of life. This LCA will produce a feasibility study that measures the impacts of AD to soil, water, air, natural resources and greenhouse gas emissions. This is a timely assessment due to interest from the public and private sector to expand AD, the combined need for organics processing capacity and simultaneous push for residential and commercial organics collection in Minnesota.

Organic materials (food waste, yard waste, etc.) currently make up one third of the waste disposed in Minnesota. This wasted resource has economic, environmental and social impacts. Minnesota is currently experiencing a shortage in organics processing capacity, which has impeded organics collection at the local level. This evaluation will assess how best to use AD to compliment other organic recycling strategies, produce clean, energy and keep organics out of the landfill.

Increasing organics recovery (for food to people, food to livestock, and composting programs) is critical, if we are to meet the legislatively mandated 75% combined recycling and organics rate for the Twin Cities Metro Area (TCMA). Organics collection is also critical if we are to meet the goals of the State's Solid Waste Policy Report and Metropolitan Area Solid Waste Management Policy Plan.

AD is an emerging technology that has not been placed on Minnesota's waste hierarchy of preferred management approaches, because the Minnesota Pollution Control Agency (MPCA) does not have sufficient information to categorize its environmental impacts and compare it to other management methods such as composting and waste to energy. This lack of knowledge about AD impedes industry growth and makes the study of AD a timely issue.

The goal of this study is to eliminate the uncertainty that surrounds AD for both the public and private sector, improve technical knowledge, and show best practices for AD and organics management. This LCA will have broad and lasting resource and environmental implications for how Minnesota permits and promotes a market for AD. Most AD facilities have been proposed in the Metro area, but there is also an interest in Greater Minnesota where many AD facilities could recover organic waste from farmers and food processors in a closed-loop system.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: Contracted Study with Life Cycle Assessment **Budget: $250,000**

There are several types of AD. Certain systems (wet vs. dry digesters) have better capacity for processing nonhomogeneous organic feedstocks. This proposed life cycle analysis will evaluate how different feedstocks (like the organics fraction of municipal solid waste source separated organics, manures, etc.), paired with different types of digester technologies (static systems, wet systems, plug--flow systems) will affect air, water, soil, GHG emissions and more. This requires an analysis of heat and electricity generation, an evaluation of the safety and marketability of the digestate (and a record of how water--intense and economically feasible the process is. The LCA and cost-benefit analysis of AD will be compared to existing LCA analyses of composting and waste-to-energy facilities in order to verify which technology elevates organics to their highest and best use.

Outcome	Completion Date
1. Literature Review of anaerobic digestion that uses edible and non-edible foods from a variety of sources (i.e. municipal, industrial/commercial, drop-site, curbside)	*August 2018*
2. Interviews of AD Programs nationally, internationally to identify common feedstocks and types of AD to test. Identify barriers to making a quality compostable digestate.	*October 2018*
3. Based on Literature Review, Design and develop a Life Cycle Analysis of different feedstocks and different AD technologies that addresses a. Water Runoff or Pollution b. Water Consumption c. Soil carbon sequestration, fertilizer replacement, water conservation, yield increase d. Toxicity/Hazards reductions e. Greenhouse Gasses f. Waste Diversion from Landfill g. Air pollution mitigation h. Energy production	*January 2020*
3. Compare LCAs of AD to those of composting and waste to energy	*April 2020*
4. Final publication including an industry-wide feasibility analysis of the anaerobic digestion of Minnesota based on economics, capacity, and technology efficiencies	*June 30th 2020*

III. PROJECT STRATEGY

A. Project Team/Partners

The MPCA will put out an RFP for a contracted study. There are many stakeholders with a vested interest who would be in support of this research, namely: waste haulers, landscape architects, state agencies, local units of government, biogas and composting NGOs, AD developers, and more.

B. Project Impact and Long--Term Strategy

Data from this program will be compiled into an online calculator that developers and researchers can use to calculate environmental impacts and the cost-benefits of AD. For example, a developer could choose their feedstock (be it a typical curbside organics mix, or a manure slurry), choose their ratio of wet to dry material, and select a type of digestion (covered lagoon, plug--flow, etc.) The calculator could identify how many gallons of water this would use, calculate energy output and identify acceptable uses for the digestate. Making this public resource will help facility operators market their product and Agency regulators set protective thresholds on what was once an unquantifiable process. This research will allow for increased collection of organic materials in commercial, agricultural, and residential settings statewide and subsequently help the Metro region reach its recycling goals. An LCA analysis will help target education for organics collection and help determine future funding and grant priorities.

C. Timeline Requirements

The study will be conducted over the course of about two years, with data made available at time of publication. At that time, an online calculator tool can be modeled using the data. The MPCA can then react to the information, using it to shape policy-decisions for AD feedstocks, operations, and digestate management. The biomass industry can also use the information to help in their planning and management of AD facilities.

2018 Detailed Project Budget

Project Title: Life Cycle Analysis of Anaerobic Digestion and Organics

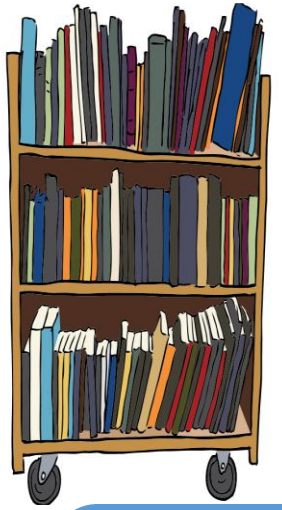
IV. TOTAL ENRTF REQUEST BUDGET 2 years

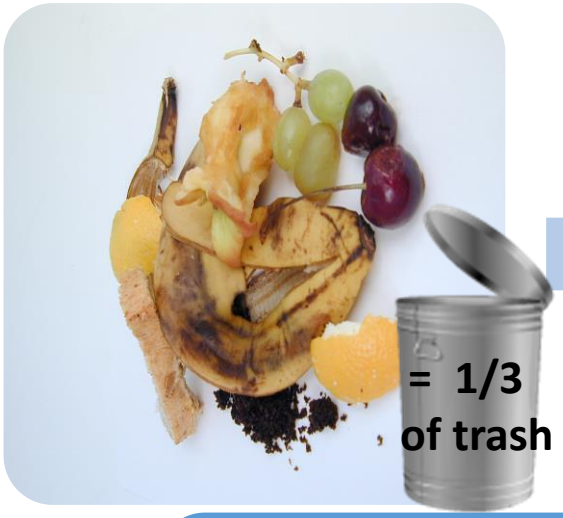
BUDGET ITEM	AMOUNT
Personnel:	N/A
Professional/Technical/Service Contracts: An RFP will be issued to conduct the Life Cycle Assessment of differnet types of anaerobic digestion using different sources of food waste and organics materials.	$250,000
Equipment/Tools/Supplies:	N/A
Acquisition (Fee Title or Permanent Easements):	N/A
Travel:	N/A
Additional Budget Items:	N/A
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND $ REQUEST =	$ 250,000

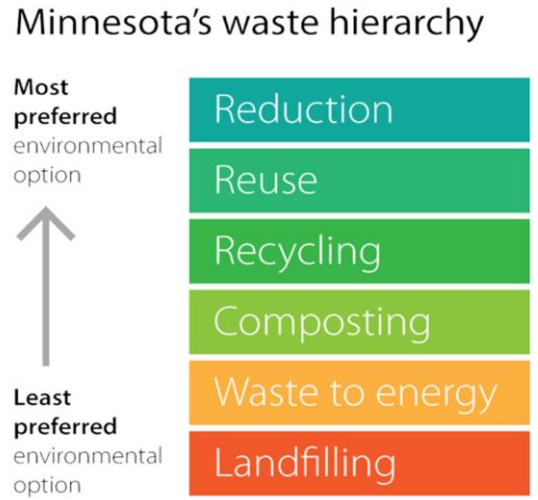
V. OTHER FUNDS *(This entire section must be filled out. Do not delete rows. Indicate "N/A" if row is not applicable.)*

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: This is an in-kind match that covers the project managers time (approximately 0.1 FTE over 2 years)	$8,000	*Secured*
Past and Current ENRTF Appropriation:	N/A	
Other Funding History:	N/A	

Life Cycle Analysis of Anaerobic Digestion and Organics







Evaluation of existing Anaerobic Digestion (AD) Research

- Research and assess current knowledge of environmental benefits and impacts of AD
- Use to scope and fine tune the next phase of research Life Cycle Analysis (LCA)

Conduct Life Cycle Analysis of Anaerobic Digestion

- Evaluate impacts of technology on
  - Soil
  - Water
  - Air
  - Climate
- Consider different feedstocks, different technologies, and other management methods

Utilize results to determine where AD fits on Waste Management Hierarchy

- Create industry life cycle calculator
- Provide policy clarity for developing industry
- Incorporate findings into state and local planning

Project Manager Qualifications & Organization Description

Kayla Walsh holds a dual degree in environmental studies and media studies from Macalester College in St. Paul, MN. She works in the Sustainable Materials Management Unit at the Minnesota Pollution Control Agency. She is a composting and recycling specialist with a focus in organics market development. Kayla works as part of a two-person organics team at the MPCA to provide technical assistance to composters, local government units, and other stakeholders who are working towards a shared goal to grow recycling and organics markets across the state. Increasing compost marketability and compost capacity will increase the municipal and commercial collection of food scraps, ultimately helping the state reach its 75% recycling goal for the Twin Cities Metro Area. In this role, Kayla co-leads a Recycling Education Committee, coordinates research on compost market development, and serves as a member on the Minnesota Composting Council. Prior to her work at the Agency, Kayla has worked in environmental consulting, outdoor education, and environmental journalism.

The mission of the Pollution Control Agency is to protect and improve the environment and enhance human health. The Minnesota Pollution Control Agency (MPCA) monitors environmental quality, offers technical and financial assistance, and enforces environmental regulations. The agency finds and cleans up spills or leaks that can affect our health and environment. Staff develop statewide policy, and support environmental education. The MPCA has made Minnesota a national model for environmental protection. The results are obvious: the air, land and water are cleaner now than they were 40 years ago, in spite of a growing population and rising industrialization. These results were possible because the agency collaborated with the state Legislature, the U.S. EPA, local governments, industry, environmentalists, educators and the public. MPCA offices located around Minnesota provide products, services and information to local citizens and businesses.

The MPCA's Core Values Include:

- People: We value and support a motivated, talented and diverse workforce.
- Leadership: We set a vision of environmental and human health protection in an open, ethical and accountable manner.
- Collaboration: We seek out and promote alliances because we value other's knowledge, opinions and abilities.
- Outcomes: We measure our success by the environmental and public health outcomes achieved.
- Data-driven: Our decisions and policies are supported by data and analysis.
- Learning organization: We promote innovation, learn from our mistakes and strive to continuously improve our processes and outcomes.