UNIVERSITY OF MINNESOTA, CROOKSTON
CENTER FOR SUSTAINABILITY

Northwest Minnesota Methane Digester Feedstock Inventory

A resource guide

Becky Johnson

4/8/2011

Introduction

The fertile Red River Valley is located in northwest Minnesota. Agriculture industry is abundant and the potential for biogas production is significant. Biogas, or methane, is produced through a process of anaerobic digestion of biodegradable materials known as feedstocks. Common feedstocks for anaerobic digestion include agricultural waste, industrial wastes and wastewater, municipal biowaste, and energy crops (Steffen, et al., 1998). If farmers, ranchers, and businesses combined their resources a successful digester could be better justified. The benefits of a renewable energy source are paramount and include decreasing greenhouse gas emissions, waste stream reduction, and providing a renewable energy source with useable by-products.

Food Processing Businesses

Through researching and contacting sources I identified methane digester feedstocks available in northwest Minnesota. The food processing industry, livestock feedlots, and community sources all have feedstocks to contribute. I contacted the Minnesota Pollution Control Agency (MPCA) to gather information on food processing businesses in northwest Minnesota. The MPCA sent me a list of food processing businesses based on their zip code and the industry description provided gave me a rough idea of what feedstocks were available.

SunOpta Ingredients Inc. of Fosston, MN does contract manufacturing of food products. The plant does not produce any viable feedstocks. SunOpta did have an Innovation & Sustainability group that could be a potential resource for more information on biogas generators. The processing plant in Cambridge, MN has a biogas generator (Jim Lambert, personal communication, March 30, 2011). The project information I requested was sent to the Innovation & Sustainability Senior Group VP for review. More information on the Cambridge, MN biogas generator and SunOpta's environmental stewardship can be found at http://investor.sunopta.com/releasedetail.cfm?releaseid=440619

American Crystal Sugar Company with locations throughout the Red River Valley in Minnesota and North Dakota, produces table sugar and has multiple by-products from processing. The company ran a pilot study in 2008-2009 on an original digester design using the beet tailings and beet pulp as feedstocks (American Crystal Sugar Company, Regional Renewable Energy Center Research Team, personal communication, July 16, 2010). Although the feedstocks proved to produce significant amounts of methane the digester system wasn't worth the financial investment of turning it full scale for American Crystal Sugar Company.

Busch Agricultural Resouces LLC in Moorhead, MN is a malt manufacturing facility. I requested information on feedstocks they may have available, but I did not receive information. The contact information I received from the MPCA query was for a manager in Missouri. Contacting the facility directly did not provide results either. However, with persistence answers can sometimes be found.

Minnesota Dehydrated Vegetables Inc. of Fosston, MN produces vegetable products. I didn't receive any information about this company from the MPCA, I knew about it from previous encounters. The company had a methane digester at their facility that treats the water from processing before it entered the city's lagoon system. The methane produced was used to offset their natural gas usage. The methane digester helped the company conserve energy and resolved city water overflow (Minnesota Project, 2004).

Crookston, MN Feedstock Resources

I conducted a methane digester feasibility study for Crookston, MN in the summer of 2010. There are feedstocks available at the University of Minnesota, Crookston campus, Polk County Environmental Services, and from smaller food processing businesses.

The University of Minnesota, Crookston (UMC) has feedstocks in the form of manure, food waste, and greenhouse/yard waste. Manure was the most abundant feedstock at approximately 621-

624 tons, including bedding, produced during the 9-month school session. Brown Dining services estimated that around 50 lbs of food is thrown away from meal trays during the 5-day week during the 9-month school session. There was also a small amount of greenhouse and yard waste produced at UMC that is composted. During the spring and summer there are approximately 400-600 lbs of dead plants and plant parts disposed of. As classes resume in August there are about 40 lbs of plant waste produced weekly. UMC did not have any waste removal fees for manure or composting (Johnson, 2010). The Center for Sustainability at UMC continuously makes green efforts for the campus and community.

Polk County Environmental Services is divided into 2 sections; East and West. West Polk was where the "Transfer Station" collected all the household waste. The transfer station also collected yard waste which is comprised mostly of grass clippings, some tree branches, and leaves. Monthly data is collected on how much yard waste was collected and brought to compost. In 2009 there were 810.35 tons collected with the highest quantity in July at 136 tons (J. Steiner, Polk County Environmental, personal communication, June 14, 2010). The grass clippings could be a good feedstock source even though they're only collected in the summer months.

Every business produces some amount of bio-waste suitable for methane digestion; similar to compostable materials. The larger quantities of feedstocks were found in agricultural and food processing industries. Some factories may produce viable feedstock however they may only be available during certain times throughout the year. Factors like this need to be considered when searching for reliable feedstock sources. Smaller businesses may produce excellent feedstocks, but these are in small quantities and feedstock storage can be difficult. Spoilage of the bio-waste can occur rapidly and methane production of the product would be greatly reduced.

County Feedlots

Methane digester feedstocks are also available from animal feedlots. Feedlots can have a difficult time getting rid of excess manure and often encounter odor complaints. Methane digestion is an option for using the manure to decrease a potent greenhouse gas (21 times that of CO_2), produce energy, decrease odors, and cut costs of fertilizers and bedding. The digested manure can be separated into liquid and dry components. The liquid is used for fertilizer and the dry portion can be used as a soil additive or livestock bedding. In the northwest region of Minnesota there are several livestock operations with significant animal numbers. The information on livestock numbers and feedlot locations can be obtained from County Feedlot Officers, or the MPCA. The MPCA provided me information on feedlots by county, along with information about each feedlot, including: owner, mailing address, phone number, feedlot name, county, animal types, number of animals, and animal units.

Northwest Minnesota County Feedlot Data

County	Number of Feedlots	Total Animal Units/County
Clay	158	29,081.495
Kittson	1	2,240
Marshall	93	11,701.2
Norman	53	14,009.935
Pennington	77	7,586.195
Polk	97	19,049.56
Red Lake	69	6,801.66

(MPCA, County feedlot [Data file])

In the data file, animals are divided by type and size to determine the number of animal units. To find the amount of manure produced, one determines the number of animal units and then uses the Annual Manure Production and Nutrient Excretion from Livestock table to determine the quantity of manure produced (MPCA, Annual manure production and nutrient excretion from livestock). Animal Unit is measured by the average weight of the animal divided by 1,000 (MPCA, Animal unit calculations). There are multiple case studies describing the pros and cons of operating an on-farm methane digester system (Johnson, 2010). Having a successful digester system is obtainable.

Summary

In northwest Minnesota there are several methane digester feedstocks available. Feedstocks come in many forms, such as: food processing waste, feedlot manure, and yard waste. The food processing industry is limited in this region. However, with American Crystal Sugar Company there is potential for synergies. There are several feedlots in northwestern Minnesota. Actual manure quantities are not known but can be calculated. Manure collection methods also need to be determined for further feasibility assessments. From my previous methane digester feasibility project I have determined that Crookston, MN has multiple sources of feedstocks available from the University of Minnesota, Crookston, Polk County Environmental Services, and the American Crystal Sugar Company processing plant. Determining feedstock availability is a base step in any methane digester feasibility project.

Next Steps

The next steps would be to secure funding; since high capital investment is the main setback to building and operating a methane digester. There are funding opportunities available through organizations such as AgStar, Onanegozie RC & D Council, MN Department of Commerce, MN Department of Agriculture, and MN Office of Environmental Assistance (Nelson, et. al., 2002). Also, finding a reputable engineer and support staff is crucial to the success of the digester. Having knowledgeable engineers will ensure that the feedstocks, usage, and geographic location is suited to the digester system. In planning one needs to take into account the necessary maintenance, repairs and upkeep of the system along with the setbacks that can occur in construction, methane production, and equipment failures (Lazarus, n.d.). A methane digester is a big investment of money and time so careful planning and consideration is required.

Acknowledgements

This feedstock resource study was funded by the Agricultural Utilization Research Institute (AURI). I would like to thank Dr. Svedarsky, Director of the Center for Sustainability, University of Minnesota, Crookston for his guidance and wisdom in sustainability considerations. The Minnesota Pollution Control Agency staff was very resourceful in providing me with information, along with the Polk County Feedlot Office. I am grateful for the cooperation of businesses and organizations in Minnesota; this project would not have been successful without your support.

References

Johnson, B. (2010). Feasibility study of methane generation of the University of Minnesota, Crookston campus. University of Minnesota, Crookston, Center for Sustainability. Unpublished.

Lazarus, W. (n.d.). Economic analysis of the Jer-Lindy farms anaerobic digester. Methane Digester Pilot Project: Implementing Cutting Edge Technology. Retrieved from http://www.mnproject.org/pdf/LCMR_Digester_factsheet_economics.pdf

Minnesota Pollution Control Agency. (2011). Animal unit calculations. Retrieved from http://www.co.kandiyohi.mn.us/depts/EnvSvcs/Feedlot/General/MPCA%20Animal%20Unit%20calculations.pdf

Minnesota Pollution Control Agency (2011). Annual manure production and nutrient excretion from livestock [Data table]. Retrieved from Reuss, S. on February 16, 2011.

Minnesota Pollution Control Agency. (2011). County feedlot [Data file]. Retrieved from Reuss, S. on February 24, 2011.

Minnesota Pollution Control Agency. (2011). Food Production Industry [Data file]. Retrieved from Snyder, M. on January 25, 2011.

Minnesota Project. (2004). Minnesota dehydrated vegetables anaerobic methane digester. Retrieved from http://www.cleanenergyresourceteams.org/files/CS_Biogas_DehydratedVeg.pdf

Nelson, C. & Lamb, J. (2002). Final report: haubenschild farms anaerobic digester updated! The Minnesota Project. Retrieved from http://www.mnproject.org/pdf/Haubyrptupdated.pdf

Steffen, R., Szolar, O. & Braun, R. (1998). Feedstocks for anaerobic digestion. Retrieved from http://www.adnett.org/dl_feedstocks.pdf