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ANAEROBIC DIGESTERS

[CAPITAL INVESTMENT] HIGH | [PAYBACK PERIOD] MEDIUM | [EMISSIONS REDUCTION] HIGH

Anaerobic digesters contain an enclosed vessel of micro-organisms that break down and process organic material in the absence of oxygen. Anaerobic digestion produces biogas, consisting primarily of methane (CH_4) and carbon dioxide (CO_2), which, depending upon the type of digester, can be combusted to run a generator to produce electricity and heat (called a co-generation system), burned as a fuel in a boiler or furnace, or cleaned and used as a natural gas replacement.[1] When the process occurs naturally, the greenhouse gas (GHG) emissions are released into the atmosphere. Anaerobic digesters control the process by trapping the biogas and burning them for energy creation. This reduces GHG emissions both by containing the emissions from organic breakdown as well as by replacing the use of natural gas or other petroleum sources for heating.

COST EFFECTIVENESS

Biogas production costs about $185/mt$CO_2$e.[2]

ENERGY SAVINGS

Each ton of organic waste processed generates 3,020 kWh, which reduces carbon emissions by 2.1 mtCO_2e.

FINANCIAL BENEFITS

Running an anaerobic digester can save $0.04/kWh. In addition, the produced energy and fertilizer can be sold.

COST

A small-scale biodigester can range from $30,000 to $80,000, depending on the amount of waste the operator expects to collect. Labor to maintain the system can cost between $15 and $20 an hour.[3]

ENERGY SAVINGS:

The U.S. Environmental Protection Agency (EPA) estimates that food waste makes up 14% of the U.S. municipal solid waste stream, making it the largest single component of landfilled material.[4] Much of this waste could be composted rather than sent to a landfill. Each ton of food, yard or other organic waste composted rather than landfilled can reduce emissions by 1–3 mtCO_2e, primarily in methane, depending on the practices used.

Each pound of food waste treated by an anaerobic digester generates about 1.37 kWh of energy, which means each ton of food waste that an anaerobic digester processes can replace 3,020 kWh of energy[5] from other sources, reducing CO_2 emissions by 2.1 mtCO_2e.

FUNDING SOURCES:

Grants may be obtained from both the state and the federal Departments of Agriculture. In addition, mortgages might be secured from organizations like the Greenstone Farm Credit Services. Another possible source of funding is Section 9007 of the Rural Energy for America Program (REAP) of the Food, Conservation, and Energy Act of 2008. This type of project may also be eligible for tax credits such as the Renewable Electricity Production Tax Credit.

1 | *DeBruyn, Jake. "Anaerobic Digestion Basics." Ontario Minestry of Agriculture, Food and Rural Affairs. July 2010. Web. 7 September 2012. <http://www.omafra.gov.on.ca/english/engineer/facts/07-057.htm#2>.*

2 | *Michigan Climate Action Council. State of Michigan. Michigan Climate Action Council Climate Action Plan. Michigan Climate Action Council, 2009. Print.*

3 | *"Small to Medium Food Wastes in New York City," Cornell University, August 1999. Web. 24 April 2012. <http://compost.css.cornell.edu/NYCComposting.pdf>.*

4 | *"Basic Information about Food Waste." U.S. EPA. Web. 10 May 2012. <http://www.epa.gov/osw/conserve/materials/organics/food/fd-basic.htm>.*

5 | *"Briefing: Anaerobic Digestion." Friends of the Earth. Friends of the Earth Trust Limited, Sept 2007. Web. 20 Jul 2011. <http://www.foe.co.uk/resource/briefings/anaerobic_digestion.pdf>.*

FINANCIAL AND ANCILLARY BENEFITS:

Anaerobic digesters have the potential to bring revenue from energy generation and from the sale of by-products from the anaerobic digestion process. It costs about $0.06/kWh to produce electricity from anaerobic digesters,[6] so a profit can be made if the energy is sold for more than $0.06/kWh. As of February 2011, the average price for a kilowatt-hour in Michigan is $0.10/kWh, so digesters can help save about $.04 per kWh.[7] Finished compost can be added to lawns and gardens to replenish nutrients in the soil. The city could sell the locally made compost to consumers to offset the costs of maintaining the system. Biodigesters can help heat nearby buildings, reducing heating costs from purchase of natural gas.

IMPLEMENTATION:

It is important to ensure the proper zoning clearance, assess the type and amount of material to be processed and final output material when selecting a digester system. Some digesters function with the intent to sell the electricity generated to utility companies, but the equipment needed to convert the waste to electricity is not always cost efficient for smaller operations. Utility-scale anaerobic digesters cost between a couple hundred thousand to several million dollars.[8] Smaller products, sized for large restaurant or supermarket-scale applications, are being developed for under $100,000. For digester performance evaluations, visit the EPA AgSTAR website: *http://www.epa.gov/agstar/anaerobic/evaluation.html.*

CASE STUDIES

CASE STUDY: FREMONT, POPULATION: 4,081[9]

In 2011, construction began on the Fremont Community Digester, in Fremont, Michigan. This digester will be one of the first large-scale anaerobic digesters using co-digestion in the United States. The digester will cost about $22 million and will process about 100,000 tons of organic and agricultural waste annually. The plant will also generate about 3 MWe of renewable electricity (which will be sold to the utility company Consumers Energy) as well as dilute liquid fertilizer and compost that can be purchased by the surrounding agricultural firms. NOVI Energy is the project developer and one of its subsidiaries, NE BioFuels, is the managing partner and minority owner. The majority owner is INDUS Energy, LLC, an investment group and the DeMaria Building Co. is the engineering, procurement and construction contractor. Comerica Bank provided the debt financing with a debt guaranty from the U.S. Department of Agriculture under the 9003 Biorefinery Assistance Program.[10]

ABOUT THE SUBURBS ALLIANCE

At the Suburbs Alliance we foster and support cooperative approaches to the challenges facing Michigan's metropolitan areas. Through innovative initiatives we organize, serve and advocate for a metro's mature cities in order to help them be vibrant, healthy and beautiful communities—preferred places to live, work and play.

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CREDITS

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A project team of more than 20 staff and volunteers contributed to the production of this work.

6 | *Meisterling, Kyle. "A broad assessment of manure to power technology and investigation of a potential wind-biogas synergy." Carnegie Mellon University. Carnegie Mellon Electricity Industry Center, n.d. Web. 20 Jul 2011. <https://wpweb2.tepper.cmu.edu/ceic/pdfs/CEIC_05_03.pdf>.*

7 | *"Average Retail Price of Electricity to Ultimate Customers by End-Use Sector, by State." U.S. Energy Information Administration. U.S. Department of Energy, 11 Mar 2011. Web. 3 Aug 2011.*

8 | *Bracmort, Kelsi. United States. Anaerobic Digestion: Greenhouse Gas Emission Reduction and Energy Generation. Congressional Research Service, 2010. Web. 20 Jul 2011. <Anaerobic Digestion: Greenhouse Gas Emission Reduction and Energy Generation>.*

9 | *"Fremont, Michigan." American Fact Finder. U.S. Census Bureau, 2010. Web. 29 Jul 2011. <http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=DEC_10_DP_DPDP1&prodType=table>.*

10 | *"Fremont Community Digester Commences Construction." NOVI Energy. NOVI Energy, 20 May 2011. Web. 22 Jul 2011. <http://www.novienergy.com/wp-content/uploads/2011/06/FCD_Press_Release-5-20-111.pdf>.*