October 2009

# FACT SHEET

## Waste Biomass Anaerobic Digestion Biogas Potential in Support of Renewable Energy Development

Michigan State University
Department of Biosystems and Agricultural Engineering

**Principal Investigator**
Steven Safferman
Phone: 517-432-0812
Fax: 517-432-2892
safferma@msu.edu
http://www.ebr.msu.edu/~safferma

**Funding Agency**
DELEG Bureau of Energy Systems
(DOE State Energy Program Grant #PLA-09-34)

**Participating Organizations**
Norma McDonald
Phase 3 Developments & Investments, LLC
normacnc5@aol.com
http://phase3dev.com/index.htm

Jim Garber
Sali Group, LLC
jgarber@saligroup.com
http://www.saligroup.com/

### Statement of Problem

Agricultural residuals such as dairy cow manure and food processing waste contain substantial amounts of carbon that can be converted to renewable energy using existing, demonstrated anaerobic digestion technologies. Currently, there are 6 farm digesters in Michigan with several additional projects under construction or planned. Further, there are 4 food processors that are using digestion in Michigan. Of these 10 digesters, five of those at dairy farms are recovering biogas for renewable energy production. Some of the other facilities, while not using the biogas to generate electricity or pipe-line quality natural gas, do use it to offset existing natural gas demand to heat the digester. Regardless, anaerobically treating high carbon content waste results in a net savings, as compared to aerating.

There is no doubt that anaerobic digestion of waste biomass is a mature technology that is both protective of the environment and a source of renewable energy. The technology has much history in Europe, the United Sates, and Michigan. However, anaerobic digestion is complex and requires substantial planning and feasibility testing to develop business plans and for design. Preliminary design steps follow.

- Clear and realistic determination of objectives.
- Literature pre-screening to calculate energy potential.
- Determination of laboratory biogas potential for the proposed feedstock.
- Evaluation and presentation of results.

### Objective

MSU and the participating organizations identified locations with large amounts of waste agricultural residuals and conducting biogas assays on the associated materials to determine if further consideration of establishing an aerobic digester with a goal of renewable energy production is warranted. Results were reported to all involved stakeholders.

This project had three distinct tasks.

1. Identify sites with good potential for the installation of anaerobic digesters and energy recovery systems, especially sites that may have not been previously identified.
2. Screen actual materials to be digested using MSU's biogas potential assay.
3. Report results to all involved stakeholders.

**Biogas Potential Assay**

The assay is a simple batch laboratory procedure using an anaerobic respirometer (Figure 1) that allows for the real-time monitoring of cumulative and instantaneous biogas production rate. The assay is customized for each sample and site-specific condition. Each assay takes between 15 and 30 days to complete. Conditions can include the examination of different blends of feedstock and the addition of acclimated cultures and nutrients. Figures 2 shows sample results from two independent biogas assays. Notice the differences in cumulative gas production that results from adding amendments or blending feedstocks.

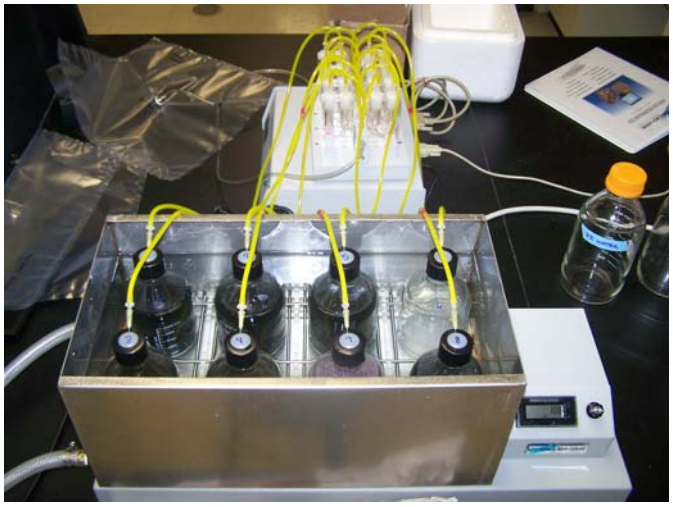

**Figure 1. Anaerobic Respirometer**

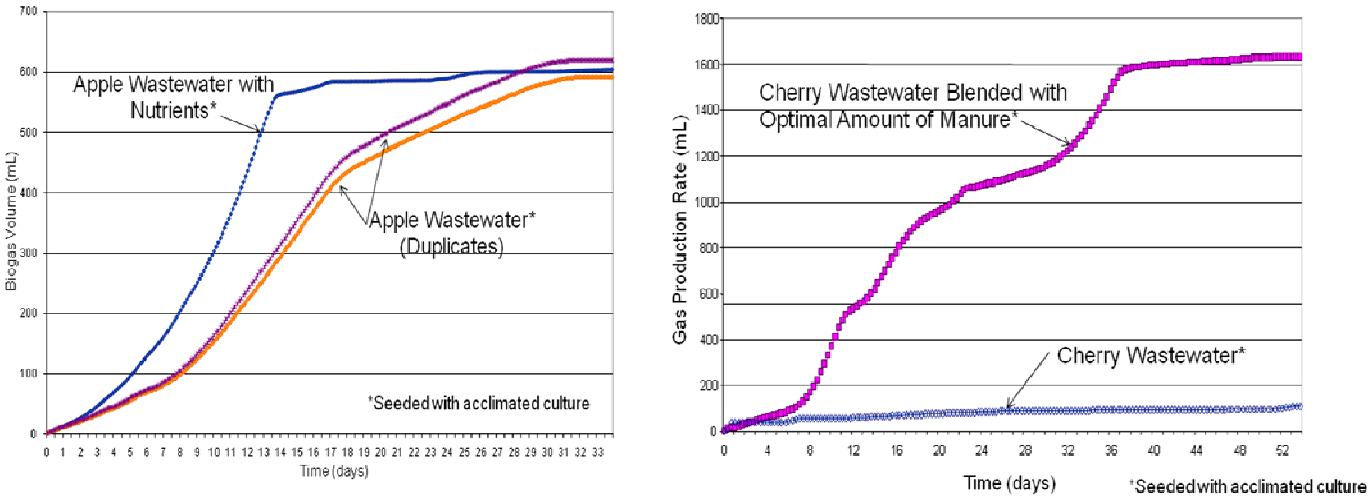


**Figure 2. Sample Results from Biogas Assay**

**State of Michigan Renewable Energy Project**

A limited number of biogas assays were conducted, at no costs to stakeholders, to identify waste streams and locations within the State that have good potential to be served by a digester connected to a renewable energy recovery system. Support was from the Michigan Department of Energy, Labor & Economic Growth, Energy Systems Bureau, Phase 3 Renewables, Sali Group, and Michigan State University.