

The Cornell Manure Management Program: Monitoring On-farm Anaerobic Digester Performance in NYS following the ASERTTI Protocol

Jennifer Pronto & Curt Gooch P.E.

Introduction:

In 2007, the Association of State Energy Research and Technology Transfer Institutions (ASERTTI) and the United States Environmental Protection Agency (USEPA) released a protocol for quantifying and reporting the performance of anaerobic digestion (AD) systems for livestock manure. In the early winter of 2008, Cornell University commenced monitoring seven New York State on-farm dairy manure-based anaerobic digesters following the ASERTTI protocol.

At the onset of the project, two of the seven digesters were receiving off-farm substrates (food wastes) and blending them with manure prior to digestion. Biogas produced by the digesters is used to fire six on-farm engine-generator sets (total capacity = 1,050-kW), one microturbine (capacity = 70kW) and two boilers.

Information available to date includes lessons learned in working through the details of how to best implement the protocol at each farm, and performance data results available as of February, 2009 (11 months of data for two farms and 5-8 months of data for the others).

Specific results include items such as:

- 1) the digesters' efficacy of waste stabilization (COD reduction)
- 2) the efficiency of utilizing the biogas generated
- 3) the ratio of electricity produced to that sold to the grid
- 4) the heat of combustion captured for beneficial use
- 5) greenhouse gas emission estimated reductions
- 6) the economics of the system.

Information found in this study will be useful not only for the farms monitored but for others who design, operate, and/or develop public policies related to anaerobic digestion.

Key monitoring provisions of ASERTTI protocol:

- Sampling and analysis of influent and effluent of AD to determine waste stabilization efficiency and concentrations of: TS, TVS, pH, COD, volatile acids
- Analysis of nutrient content of substrates added (TKN, NH₃-N, TP, OP, K)
- Biogas production: quantity used to produce electricity, heat and amount flared (not used)
- Biogas composition: H₂S, CO₂, CH₄ concentrations
- Biogas utilization: electricity, parasitic heat, beneficial heat
- Economic analysis
- Greenhouse gas emissions reductions

THE CORNELL MANURE MANAGEMENT PROGRAM conducts applied research, and develops and distributes findings to several key stakeholders including: the New York State and U.S. dairy industry, state & federal government agencies, private industry, the general public, and academic institutions.

Current activities include:

(1) Applied Research

- NYSERDA anaerobic digester monitoring study includes performance data collection/analysis of 9 digester systems in NYS
- National Air Emissions Monitoring Study: Northeast dairy site
- Feasibility study for Kraft Foods, Inc., Lewis Co. dairy producers, and the Lowville, NY community to build a centralized AD

(2) Outreach & Extension

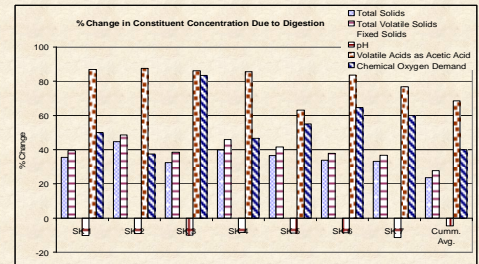
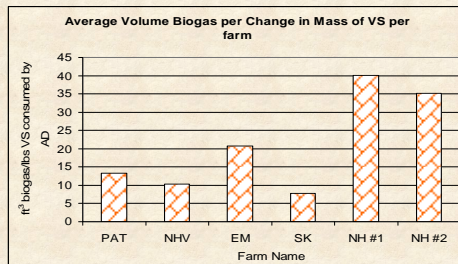
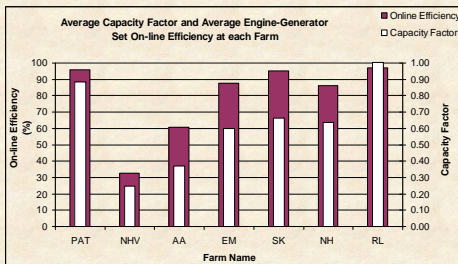
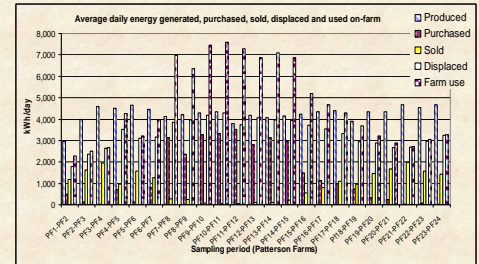
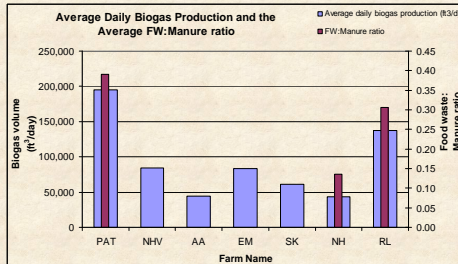
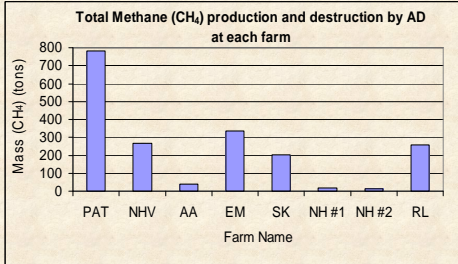
- The Technology Transfer project seeks to convey technical implications from research based initiatives to key stakeholders
- Provide a constant presence for the dairy industry, and be a source of unbiased information
- General education of biomass-to-energy issues for the public and for policymakers
- Founder and publisher of *Biogas News*, a newsletter distributed nationally to anaerobic digester owners/operators and other stakeholders in the U.S. Biogas Industry
- Formation of a website to centralize information on AD as well as specific information on NYS AD

(3) Project Partnerships

- Innovation Center for U.S. Dairy: "Dairy Power" initiatives seeking to improve the long-term sustainability of the U.S. dairy industry
- Gas Technology Institute: researching opportunities for biomethane insertion to natural gas pipelines
- U.S. EPA: AgSTAR program potential partnerships
- Lars Angenent lab: providing high-level substrate analysis for local farms
- Norm Scott: collaboration on the Technology Transfer project and other AD and sustainable-dairy related initiatives

WWW.MANUREMANAGEMENT.CORNELLEDU

Preliminary findings



Ongoing work:

The next step in the project is to complete the required 12-month (52 weeks) cycle of monitoring at each of the seven farms. The time left to complete monitoring at each farm is:

- PAT: 6 weeks
- NHV: 12 weeks
- AA: 42 weeks
- EM: 12 weeks
- SK: 22 weeks
- NH: 38 weeks
- RL: 36 weeks

After monitoring at each farm has been completed, data will be analyzed and a report written for that farm. Upon completion of monitoring at all farms, an aggregated report will be prepared to compare results among farms with varying designs and management techniques. Further analysis will include investigation of the impacts on the digester system of substrates added, using substrate addition logs and biogas production data. Statistical analysis and regressions will also be performed to determine the significance of the data.

Implications:

The primary goal of the study is to provide participating farms with performance results for their digester. Performance data includes several parameters that indicate the efficiency and success of the AD system. These results show annual trends and will allow the farms to make management decisions where there are opportunities for improved efficiency and optimization.

Findings will also be made available to the public, including digester system designers as well as potential digester project owners. Information from the study can be used to improve future AD design criteria. Conclusions showing promising AD performance will encourage funding for future AD projects.