

Establishing Performance Protocols for Anaerobic Digestion

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Support

- Association of State Energy Research and Technology Transfer Institutions (ASERTTI)
- U.S. Environmental Agency's AgSTAR Program
- U.S. Department of Agriculture Rural Business Service

Purpose

To provide:

1. System developers with a standard approach to quantify performance and support claims that will receive general acceptance as credible, and
2. Third parties with the same approach for independent performance evaluations.

The Development Process

- Preparation of first draft for discussion,
- A workshop held in Chicago in late January to review and provide suggestions for revisions,
- Preparation of a final draft, and
- Solicitation of additional comments and suggestions.

Structure of the Protocol

- Prerequisites for performance evaluations
- Specification of required background information
- Requirements for characterizing performance with respect to:
 - Waste stabilization
 - Biogas production and utilization
 - Greenhouse gas emissions reductions
- Standards for economic analysis

Prerequisites for Performance Evaluations

- Full-scale systems located on commercial livestock operations
- A minimum of 12-months in duration
- Steady-state conditions after completion of start-up (minimum requirements)
 - Plug-flow & mixed digesters: 5 HRTs
 - Covered lagoons: one year
 - Attached film digesters: 3 months of warm weather operation

Required Background Information

- Name, location, and type of operation
- Type, age and number of animals
- Type of manure handling system
- Type of digester and design details
- Type of biogas utilization system with design details
- Source(s) of revenue from biogas production

Waste Stabilization

- Parameters:
 - Minimum: TS, TVS, COD, and pH
 - Optional: TVA, TKN, ON, $\text{NH}_4\text{-N}$, TP, indicator organisms, and pathogens
- Sample collection: representative composites of 24-hour flows
- Frequency of sample collection: monthly or semi-monthly?
- Sample preservation and analytical methods

Biogas Production & Utilization

- Measuring production: total and utilized
- Biogas composition: CH₄, CO₂, H₂S, and NH₃
- Utilization:
 - Generating electricity: kWh generated, thermal conversion efficiency, and waste heat recovered and utilized or potentially available
 - Boiler fuel: Conventional fuel Btu replaced
- Reporting standards: The per animal-day problem with co-digestion

Greenhouse Gas Emissions Reductions—Methane

Baseline emissions are functions of: 1) the previous method of manure management (*e.g.* daily spreading vs. anaerobic lagoons vs storage tanks and ponds *etc.*) and 2) climate.

Methodology Guidance— Methane

- Methodology for Estimating CH₄ & N₂O Emissions for Manure Management (Annex 3.10 in the Inventory of U.S. Greenhouse Gas Emissions: 1990-2004, USEPA, 2006) (<http://www.epa.gov/climatechange/emissions/usinventoryreport.html>)
- The USEPA Climate Leaders Draft Manure Offset Protocol (www.epa.gov/climateleaders/docs/ClimateLeaders_DraftManureOffsetProtocol.pdf)

Methodology Guidance—CO₂

- EPA's Power Profiler (www.epa.gov/cleanenergy/powerprofiler.htm) based on EPA's Emissions & Generation Database (www.epa.gov/cleanenergy/egrid.htm)
- Estimates greenhouse gas emissions per MWh of electricity generated by geographic location based on fuel mix.

Economic Analysis—Costs

- General approach: an independent enterprise
- Boundary conditions: exclusions and inclusions
- Annual capital cost: cannot exclude recovery with interest of an owner's investment
- Annual operating and maintenance costs: a better basis for estimation is needed

Economic Analysis—Revenue

- Valuing on-farm energy use: rate structure differences and demand charge impacts need to be included
- Revenue from by-products: what is valid and what is not

Next Steps

- Selecting a gatekeeper
- Establishing a review process
- Establishing and maintaining a distribution process (probably a website)
- Considering a certification program

The Protocol is available at:

- [www.aserti.org/partenerships/digester/
default.htm](http://www.aserti.org/partenerships/digester/default.htm)
- www.epa.gov/agstar/resources.html