Anaerobic Digestion in the U.S. Livestock Industry:
AgSTAR Program and Technology Update

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USDA Digester Standards

- Anaerobic Digester - Ambient Temperature
  - Code 365

- Anaerobic Digester - Controlled Temperature
  - Code 366

- Waste Facility Cover
  - Code 367
PS - 365 Anaerobic Digester - Ambient Temperature

Purposes:

Air Quality Issues

Greenhouse Gas Emissions Reduction

Renewable Energy
PS - 366 Anaerobic Digester - Controlled Temperature

Purposes:

- Air Quality Issues
- GHG Reduction
- Pathogen Reduction
- Renewable Energy
NRCS Practice Standards
Anaerobic Digester - **Controlled Temperature**

**Plug Flow Digester**

TS = 8% * to 14%

* ruminant ≥ 11%

RT ≥ 20 days

Mesophillic Temp.
Mixed Digester

- TS = 2.5% to 10%
- RT ≥ 17 days
- Mesophilic Temp.
- Appropriate Mixers
NRCS Practice Standards
Anaerobic Digester - Controlled Temperature

**Fixed Film Digester**

TS $\leq 5 \%^*$

* $\leq 1/4”$ particle

RT 1 to 6 days

Temp. 59 F to 103 F

Microbial Support $\geq 3 “$
Alternative Digester Design

Other Designs shall be based on:

• documented design
• documented performance
• certified as such by PE
NRCS Practice Standards
Waste Facility Cover

**Inflated Covers – Code 367**

- Warning system - blower failure
- Support system - equipment access
NRCS Practice Standards
Waste Facility Cover

**Rigid Covers -**

- Practice Std. 313, Waste Storage Facility
- Fail Safe pressure relief
Operating Status of Farm Scale Animal Waste Digesters

• Criteria
  – Minimum 1 year of steady state operation at design capacity
    • Gas data or kWh meter are good performance indicators
  – Replication provides additional validity of process performance and risk assessment
  – Other important parameters
    • Load factor >85%
    • Net energy (less parasitics)
Operating Status

- Ambient Temperature (Dilute wastes <2% TS)
  - Bank-to-bank covered lagoons
  - Modular covered lagoons
  - Attached media
    - Operating in Florida @mesophilic range

- Heated (mesophilic) Digesters (Thicker wastes @3-12% TS)
  - Unmixed flexible top plug flow
  - Vertically mixed rigid top plug flow
    - Plug types as rectangle, horse shoe and round
  - Mixed flexible top
  - Mixed tanks (Glass fused and concrete)
  - Mixed bank-to-bank insulated covered lagoon

- Gas utilization still limited to reciprocating engines, boilers, and flares
  - One micro-turbine operating as ancillary to recip. engine
Alternative Designs

• Some planned, in construction, startup, or at steady state
• Include heated digesters (mesophilic range)
  • Two phase processes
  • Anoxic processes
  • Induced Blanket
  • Hybrid systems
  • Some combine sand removal and management processes
  • Some consist of infrequently collected high solid manure

• Remember criteria
  – Minimum 1 year of steady state operation at design capacity
    • Monthly compiled gas data is good indicator of performance and process stability
Current U.S. Digester Status

In 2003
All projects @190 million kWh equivalent
100 projects; @65 operating or in construction and 35 planned
What About Costs?

Financial Performance
Costs of 35 Commercial Digester Projects

Breakeven Price (kWh) vs. Cost per kW Installed
AgSTAR Program

• New products and updates:
  – Handbook
    • Updated edition includes centralized system assessment methods
  – FarmWare: Digester Pre-feasibility Software
    • Updated technologies, costs, and comparative performance reports
  – National and State Funding Guide
  – State Market Opportunities
    • National and state energy and GHG reduction report based on farm characterizations
  – Series of Environmental Performance Reports
    • AA Dairy and Patterson Farm

• National Conference, St. Louis, March 24-25
  – Agenda at www.epa.gov/agstar
Don’t Let This Happen to You!

Thank You
What About Costs?

Digester Costs

Cost per kW Installed

- $25,000
- $20,000
- $15,000
- $10,000
- $5,000

- $-
Overview

- Operating Technology
  - Updated USDA Digester Standards
  - What’s working
- AgSTAR Program
  - Handbook
  - FarmWare
  - National and State Funding Guide
  - State Market Opportunities
  - Standardized Assessments and Reports
Components of Standards

• Definition
• Practice Application
  – Operator interest
  – New or existing farm
• Digester Criteria
  – HRT, loading rate, TS
• Gas collection, transfer and control,
• Biogas use
  – Flares, engines, boilers
Basis for Criteria Development

NRCS Review Process

Project Experience