From Waste to Watts: Methane Recovery for Power Generation

Sustainable Biosolids Management in the Future

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Overlapping Goals and Problems Bring Potential Opportunity

**Candidate City**
- **Goal:** A new, affordable wastewater treatment plant
- **Opportunity:** Methane gas recovery
- **Problem:** Where to market the power generated?

Existing regional wastewater plant
Overlapping Goals and Problems Bring Potential Opportunity

- Local dairy farms
  - Opportunity for expansion to meet demands of several fluid milk & cheese facilities
  - Problem: Larger herds mean more manure
    - Greater land application needs
    - More problems meeting NPDES permit regulations
    - More production issues such as odor control
Overlapping Goals and Problems Bring Potential Opportunity

**Industrial Heating/Electric Utility**

- Problem: Running low on sources of power
- Opportunity: Find local producers to reduce need to purchase from other utilities
- Provide long term fuel feedstock for digester using renewable energy Source, i.e. manure
Feasibility Study Will Determine If Process Is Locally Viable

Digester

Gas, CH₄

Burn/Gen.

Heat/Elec.

WWTP

Treated Solids (fertilizer)
Biogas Generation Offers Benefits to Many

- Increased potential for funding can help area municipalities pay for biosolids facilities
  - Playing the “green/renewable energy” card can increase chances of selection in standard grant award processes
  - Collaborative and renewable aspects of project offer additional potential grant sources
Biogas Generation Offers Benefits to Many

- Low cost “green power”
  - Enhances the region’s reputation as an environmentally responsible producer
  - Provides utilities with a fixed-cost source of power
  - Helps utilities meet mandated alternative energy source goals
  - Provides municipalities with a new potential revenue stream
Biogas Generation Offers Benefits to Many

- Treatment and disposal of dairy wastes reduces the need for on-site storage, handling, and land application
  - Offers potential manure handling cost savings
  - Helps reduce odors
  - Protects the local watershed
  - Provides economic development incentives for locating more dairies to the area
Biogas Generation Offers Benefits to Many

- Treated dairy manure conserves nutrients, has value as fertilizer
  - Treated, dewatered product
    - Provides local farmers with consistent quality solids for land application
    - Has less offensive odor than untreated product
    - Reduces costs because it requires less handling and management
Biogas Generation Offers Benefits to Many

- Local dairies can potentially gain pollution credits associated with the capture and combustion of methane
  - Closed loop process would meet criteria for credits
  - Reduction of greenhouse gases, carbon sequestering and other air quality issues have potential long term benefits to the community
Biogas Generation Offers Benefits to Many

- All participants will benefit from the positive impact on area economic development
  - Utilities
  - Local dairies
  - Area municipalities
  - Local farmers
  - Local businesses
  - Regional fluid milk & cheese processors
Biogas Generation Offers Benefits to Many

- Rural America losing population and potential
  - Good soils: high nutrient needs
  - More dairy cows needed: high level understanding of dairy industry
  - Sustainable economic development opportunities: more jobs, livable communities
  - Significant savings: no more large manure storage lagoons by building a “wide spot” in the process and transporting
Potential Pitfalls in the Process

- Fuel Source Issues
- Heat Loss and BTU’s
- Energy Value
- Co-mingling Wastes Issues
- Transportation Issues
Co-mingling of Municipal Biosolids and Manure?

- Technology to treat biosolids
- Methane is methane
- Presence of metals
- Monitor loading and land-spreadin rates
Transportation Issues

- Milk Run concept of biosolids management is economically being done into Ellsworth, WI from as far as 60 miles.
- Comparative savings in transportation versus lagoon storage and spreading.
- Moving waste material out of the watershed for treatment can benefit TMDL wasteload allocations for the basin.
Project Phases

- Feasibility Study
- Project initiation
- Design and construction
- Operation and maintenance
What the Feasibility Study Will Determine:

- Location of Facilities
- Capacity
- Hauling vs. De-centralization
- Customers
- Capital Investment
- Return on Investment
The Payoffs

- Municipalities could improve their biosolids management options
- Sustainable revenue for both agriculture and municipality from biopower sources
- Treated biosolids possess fertilizer value and potential new products
- Pollutant credits, water quality credits, and economic benefits value-added
What do the Preliminary Numbers Tell Us About the Fuel Source?

- Municipal biosolids provide approximately 750 BTU’s per gallon @ 1.5%.
- This energy potential translates to 900 BTU/day per equivalent person.
- Dairy waste provides approximately 1,500 BTU’s per gallon.
- Dairy waste = 40,000 BTU/day/cow.
Heat is Lost, then Re-Captured

- IC Engine is only 30% efficient
- For every 1,000 BTU’s, only 300 BTU’s are sent to the generator
- 250 BTU’s is recovered as waste heat
- For digestion heating purposes, waste heat is comparable to saving 1 out of every 4 cu.ft. of gas
Estimated Value of End Products

- $90,000 /yr in energy
- $60,000/yr in heat value
- Treated biosolids possess fertilizer value
- Farmers can get pollutant credits for elimination of greenhouse gases
BTU’s are the Prize

- 1,000 cows = 40 million BTU's/day
- 20,000 pop. = 18 million BTU's/day
- Based on 30% efficiency, the energy generating facility = 5,000 kw-hr/day
- 280 continuously-running HP