Assessing the economic viability of anaerobic digester system on dairy farms in NYS through the use of mathematical models

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Introduction

What is anaerobic digestion (AD)?
- Biological treatment process, may be applied to farm manure
- Produces biogas
- Biogas burned in CHP (combined heat and power) generation
- Aids in management and storage of manure (CAFO regulations)
- Odor reduction
- Greenhouse gas reduction

Who should consider implementing an AD system?
- USDA AgSTAR program: considers anaerobic digestion to be an economically viable method of manure treatment for farms with more than 500 cows.
- According to the 2007 Census of Agriculture, only 3% of NYS farms have at least 500 cows. Looked at another way, only 33% of NYS cows would be seen as a potential resource for anaerobic digesters.

Background on current incentives

Net metering is a system in which a farm is essentially allowed to use the grid as an energy bank. Energy produced by the AD-CHP system that exceeds the demand of the farm can be transferred to the grid and redrawn when farm demand exceeds production. At the end of the year, excess electricity is sold to the grid at wholesale prices.

RPS incentives or Renewable Portfolio Standard Incentives is a NYSERDA program that grants funding to farms installing AD-CHP systems. Current funding grants a capacity incentive of $500 per kW of ADG-rated capacity of the engine generator set and a performance incentive of $0.10 per kWh of produced electricity for the first three years.

Research Questions and Results

At what size will a farm implementing an AD system (anaerobic digester, bedding separator, engine-generator) be economically feasible within a 10 year period given current incentives?

What are the major sources of income and savings associated with an AD system?

What are the major costs associated with an AD system?

Conclusions

- Anaerobic digester systems are more profitable at a larger scale.
- Community digesters are a potential way to allow smaller farms to treat manure through anaerobic digestion.
- Net metering is essential for the profitability of AD systems. Although only 3% of the income is due to electric sale, net metering allows farms to maximize their electric savings, which is one of the largest pieces of the pie.
- RPS incentives are an effective way to aid farms to implement AD systems. Though, RPS incentives alone cannot make AD systems feasible, they are a necessary support for many prospective farms.
- Increasing incentives:
  - Capacity incentive to $1000/kW decrease feasible size to 500
  - Production incentive to $0.2/kWh decrease feasible size to 400

Future Work

ADSS (Anaerobic Digestion Simulation Software) implement in MATLAB® & SIMULINK® with the following objectives:

- To provide a mathematical tool that enables users to optimize design and operation of AD-CHP systems
- To aid the policy making community to identify incentive structures needed to promote AD technology

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