VERMONT’S EXPERIENCE WITH THE ADOPTION OF ANAEROBIC DIGESTERS

Dan Scruton

VERMONT AGENCY OF AGRICULTURE, FOOD AND MARKETS
Vermont is a dairy state
Vermont has about 145,000 cows on 1100 dairy farms (average 130 cows per farm)
Over 80% of Vermont’s Agricultural Gross Income is from Dairy
Most Farms grow their own forage
What is the Current Status in Vermont

- We have 13 systems that are operational
- Eight new systems in development under the SPEED Program
- Three system upgrades
- Several in planning stage
- If all come on line we will have 7 megawatts of generating capacity
- Our 25x’25 Committee predicted 15 megawatts from manure based systems 30 megawatts from crops and substrates
Vermont Methane Pilot Project

- Started in 1999 with DOE funds
- Initially wanted to set up pilot sites
- Decision to step back and determine why the systems from the 1970s and 80s did not catch on (and why 80%+ failure rate)
Program Mission

- Identify, and help overcome, the strategic hurdles to widespread adoption of agricultural methane recovery and use technologies.
What Did We Do?

- Vermont Methane Pilot Project Initial Literature Search
- Resource Assessment
- Attached Growth Research
- Preliminary feasibilities
- Demonstration sites
What Hurdles Did We Find?

- MARGINAL ECONOMICS
- Traditional designs only suitable for largest farms
- Sale to grid was complicated
- Low wholesale price
Hurdles

- Perception of complicated operation
- Designs that are not suitable for the way a farm manages
- Problematic designs causing high maintenance
- Most designs have heat pipes in the digester chamber.
Hurdles

- Time.
- Farmers already working long days and do not want more headaches.
- Farm needs to have an individual(s) that want to make it work.
- DO NOT TALK A FARM INTO ONE.
Hurdles

- Gas quality
  - low BTU
  - $\text{H}_2\text{S}$ is corrosive

- Little to no existing service industry

- Ancillary benefits not quantified
What Policy Changes Were Made?

You need to change the economic drivers

- Net metering
  - Including group net metering for farms
  - Easier, lower cost design of system in many cases only would need to digest the liquid fraction
  - Displaces retail power while having the Grid as a back-up system.
What Policy Changes Were Made?

- Having strong net metering rules give utilities significant incentives to develop alternatives.
- CVPS Cow Power 4 cent premium per kWh of power sold to grid on top of wholesale contract.
  - Customers stepped forward that voluntarily pay the extra 4 cents
  - Currently demand is exceeding supply and the excess collections are put into a development fund and granted out to encourage farms to install systems.
What Policy Changes Were Made?

- **Bedding Study**
  - Bedding costs often exceed electrical bill
  - We funded a Split herd study to validate digested manure solids as a bedding material
  - Carried out by Dr. John Barlow, UVM
  - Farmers needed reassurance the practice could be done
  - After 20 years running the state’s mastitis control program I wouldn’t have predicted I would be recommending manure solids for bedding
2009 legislature authorized a 50 megawatt standard offer program

Program gave a predictable price for 20 years in a power purchase agreement

Prices paid based on developers being able to get a reasonable rate of return

Two steps, fast-track if the statutory levels are reasonable and then a more refined price
Draft Modeled Prices by Farm Size to Achieve 12 1/8% Return on Equity

All prices are preliminary approximations only the 1000 cow number is based on existing systems. Farm size is based on milking age dairy animals housed in a system where the manure is harvestable.

- 1000 cows $0.21 per kWh
- 500 cows $0.21 per kWh
- 300 cows $0.25 per kWh
- 150 cows $0.36 per kWh
- 100 cows $0.50 per kWh
- 75 cows $0.52 per kWh
## Standard Offer Prices

<table>
<thead>
<tr>
<th>Resource</th>
<th>Landfill Methane</th>
<th>Farm Methane</th>
<th>Wind (15kW or less)</th>
<th>Wind (over 15 kW)</th>
<th>Solar PV</th>
<th>Hydro power</th>
<th>Biomass</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Statutory Price</strong></td>
<td>$.012</td>
<td>$0.12</td>
<td>$0.20</td>
<td>$0.125</td>
<td>$0.30</td>
<td>$0.125</td>
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<tr>
<td><strong>Interim Price</strong></td>
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<td>$0.16</td>
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<td>$0.30</td>
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<tr>
<td><strong>Final Levelized Price</strong></td>
<td>$0.09</td>
<td>$0.1411</td>
<td>$0.2148</td>
<td>$0.1182</td>
<td>$0.24</td>
<td>$0.1226</td>
<td>$0.125</td>
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Vermont Agency of Agriculture, Food and Markets
Dairy of the Future

- Biological Fuel Cell
- Anaerobic Digester
- Liquids
- Solids
- Gas
- Energy
- Algae Growth System
- Bedding and compost
- Solids to protein sales and soil amendment
- Oil to food and energy
- Electricity
- Heat

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Free by ‘50