

Vermont Experience With Anaerobic Digesters



Dan Scruton

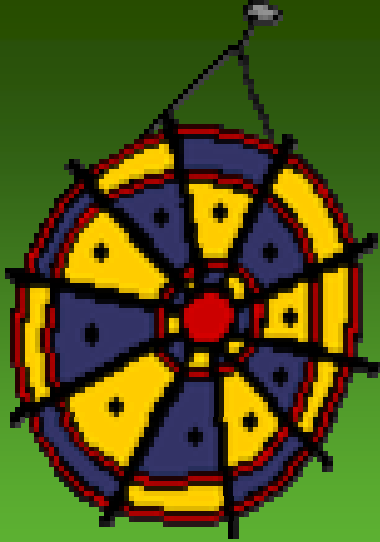


Vermont Methane Pilot Project

- Started in 1999 with DOE funds thanks to Senator Jeffords
- 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



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**
 - ◆ **Most of the systems from the 1980's no longer in use**
- **Resource Assessment**
 - ◆ **Cows = 28 megawatts**
- **Attached Growth Research**
 - ◆ **Dramatically shorter retention times are possible**

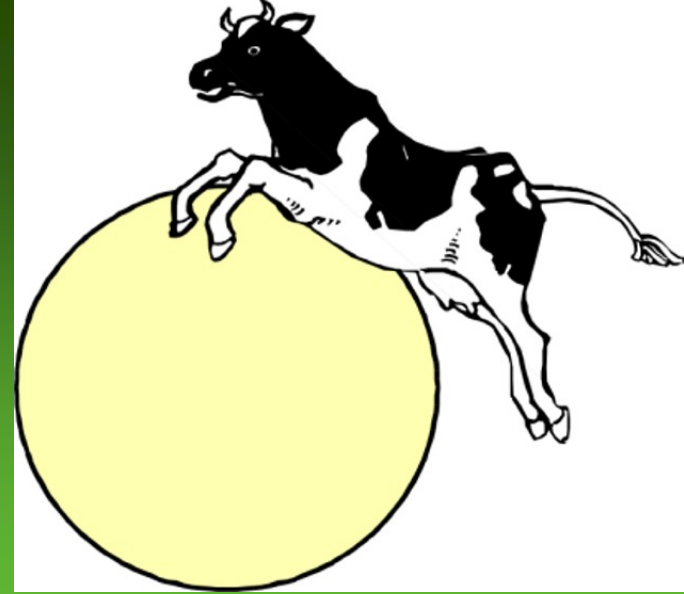


Feasibility farms



- **Positive cash flow in the 500 cow and up**
 - ◆ **7 year pay-back or better**
- **300 to 500 cows positive if put a value on odor**
- **Small farms may be viable for hot water only systems if manure liquid or niche (making cheese so have supply of whey)**
- **Farmer generally gets better return on capital with other uses of the money**

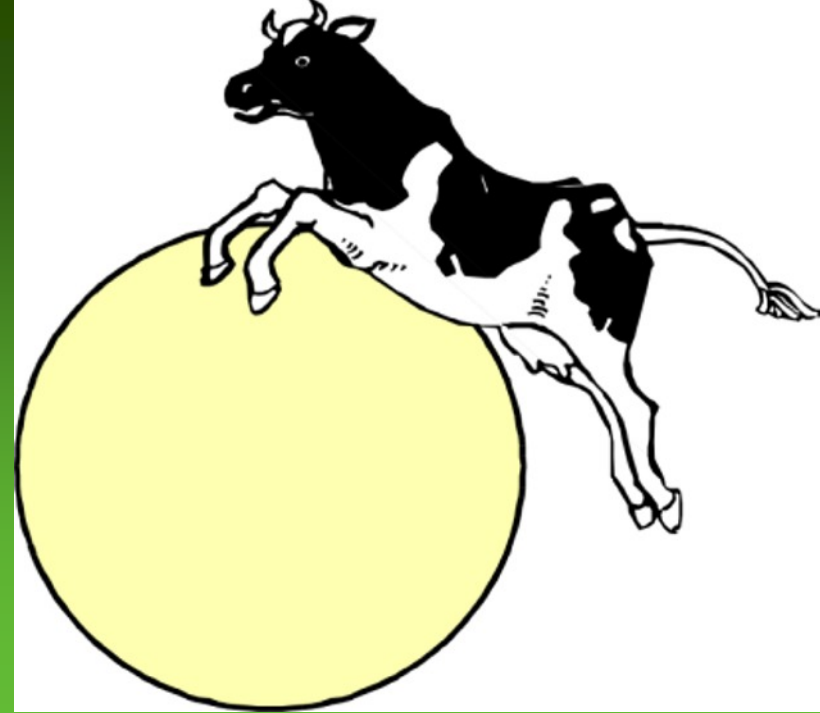
Hurdles



- **MARGINAL ECONOMICS**
- **Traditional designs only suitable for largest farms**
- **Perception of Complicated Operation**
- **Problematic designs causing high maintenance**

Hurdles

- **Gas quality**
 - ◆ low BTU
 - ◆ H_2S is corrosive
- **Sale to grid was complicated**
- **Low wholesale price**
- **Little to no existing service industry**
- **Ancillary benefits not quantified**





Hurdles



- **Time.**
- **Farmers already working long days and do not want more headaches.**



Hurdles

- **Significant problems with recent systems**
- **Technology need to improve before widespread adoption is recommended**
- **Hasn't slowed the flow of salespeople**



Solutions

- **Legislative**
- **Technical**
- **On-farm**



Just keep nibbling away.



Net Metering

- **Credit power from generation meter to other farm meters**
 - ◆ **Barns, houses, employees, etc.**
- **150 kW max**
- **No demand or time of day charges**
- **Simplified regulations while still safeguarding safety and power quality**
- **Can “BANK” power for one year**





Existing Demonstration Site

- **Foster Brothers Farm in Middlebury, VT**
 - ◆ **Active digester since 1982**
- **Side-by-side system**
- **Investigate simpler designs**
- **Reduce maintenance**
- **Shorter retention times**
- **Can try things without major expenses**





Research at Fosters

- **Steam for heating**
 - ◆ **Reduced start-up from months to weeks**
 - ◆ **Gas output starts much faster**
 - ◆ **Excellent at dealing with frozen manure**
- **Economics reasonable on whole manure systems**



New On-Farm Systems?

- **Three systems are under construction**
- **Plug Flow**
- **Vertical Plug Flow Tank**
- **Mixed Tank Attached Growth**





Whole Manure Horizontal Flow

- **“U” shaped cross agitated plug-flow digester**
- **20 day retention time 100°F**
- **Generator selling all of its power to the utility**
- **Working with CVPS on Cow Power**



Digested Solids for Bedding

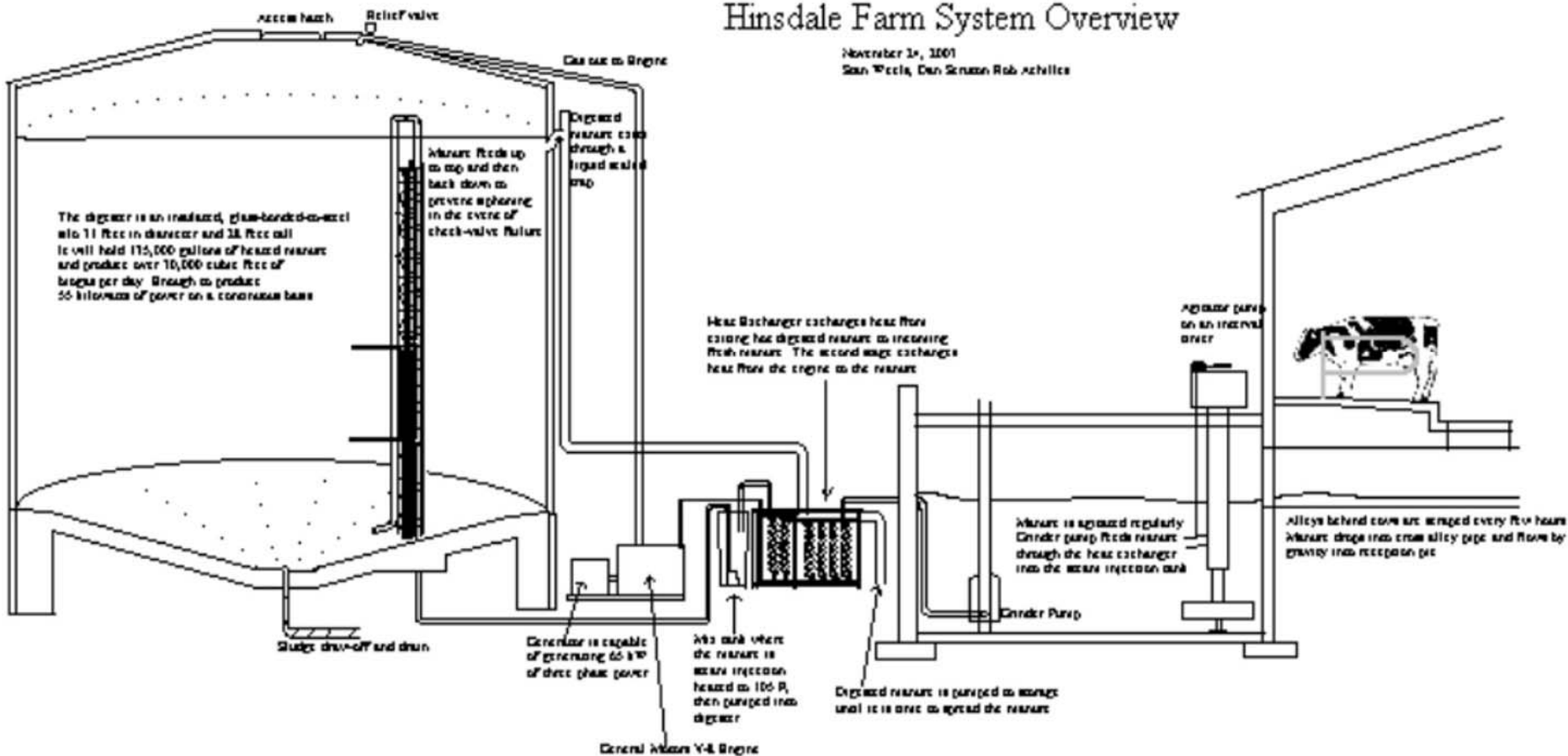
- **Separating manure after the digester**
- **Digested solids**
 - ◆ **1/2 Dried down partial for use as bedding**
 - ◆ **1/2 Available for land use or sale off farm**

Whole Manure Vertical System



Hinsdale Farm System Overview

November 24, 2001
Sean Peck, Dan Scruton, Rob Achilles





Swamp-On-A-Rope

- **Totally different approach to manure handling**
- **Separate manure first**
- **Liquid to a digester designed to:**
 - ◆ **Be delivered fully assembled**
 - ◆ **Digest in 2 days (normally 20)**
- **Liquid then goes through a system that outputs:**
 - ◆ **Nutrients in a sludge**
 - ◆ **Clear water that meets EPA discharge standard**



Major Ramifications

- **No hauling water around on the roads**
- **No liquid manure storage to stir**
- **No odors from spreading liquid manure**
- **Potentially the nutrients will be segregated between P and N**
 - ◆ **Farmers could easily match application rates to soil needs**





Thank you
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Vermont Agency of Agriculture, Food and Markets