


SEBESTA BLOMBERG  
Providing Technical & Business Solutions



## Keys to a Successful Project

Presented To:

### Iowa Farm Bureau Federation Biogas Seminar

By:

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SEBESTA BLOMBERG & ASSOCIATES, INC  
[www.sebesta.com](http://www.sebesta.com)

February 28, 2007

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### *Motivation for Biogas*

- Control Odor
- Reduce Solids and Related Handling Expenses
- Meet Agronomic Rates for Land Application of N, P and K
- Gain New Revenues from By-Products
  - Bedding
  - Composting
  - Nutrient Concentrate




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### *Project Failures*

- Local market price for electricity
- Poor engineering
- Use of sand bedding material not compatible with digestion system
- Technology still largely experimental
- Unreasonable expectations of outside investors

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*Project Failures*

- More maintenance than expected

*To solve these problems, a large amount of high-level management time had to be diverted from tending to the dairy cows to digester repairs.*

- Revenues could not justify the resources for continued operation




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*Keys to Success*

**Considerations for Success**

- Business
- Energy Outlook
- Feedstock Quality
- Utility Infrastructure
- Technology
- Operator Requirements
- Regulatory Requirements

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*Business*

- Agriculture is the *business* of
  - collecting
  - storing
  - refining solar energy
- Most efficient process adds highest value over the entire business cycle

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- Food is simply the highest value energy product like gasoline in a refinery
- Fertilizer is a co-product energy stream
- Crop residue, animal and process wastes are like the tar in the still bottoms

*Finding a use for these improves the efficiency of the entire system.*

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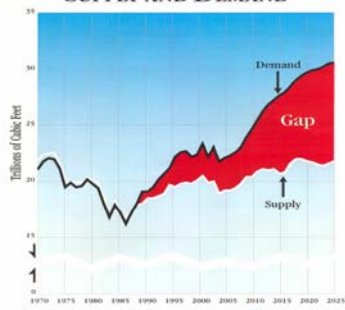
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**WORSENING GAP  
BETWEEN DOMESTIC NATURAL GAS  
SUPPLY AND DEMAND**



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- Bush Administration predicts prices near \$5.40 in 2025 in 2004 dollars
- A More Likely Scenario
  - Natural gas demand will exceed supply for the foreseeable future
  - Best predictor of natural gas price is oil price per barrel divided by 5.8
- Corn prices > \$3 per bushel



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*Feedstock Quality*

- Feed stock consistency is key
  - Digesters like a steady source of consistence food strength
- Correct balance of nutrients
- Use of substrates for increased production
- Choose right digester technology
  - More variable waste stream(s), greater the need to complete bench scale evaluation studies
  - Pathogen reduction




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*Feedstock Quality*

**Minnesota LCMR Research**

- Evaluation of increasing methane production by blending hog manure and various biomass sources
  - corn stalks, switchgrass and sugar beet pulp
- Bench-scale batch testing in a 5 to 10 gallon digester equipped with mixing and temperature control




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*Feedstock Quality*

**Minnesota LCMR Research (continued)**

- Preliminary results
  - Switchgrass and sugar beet pulp not promising
  - Corn stover has good gas production potential
    - 50 to 75% of the heating value of the stover recovered as methane
- Final results expected first quarter 2007




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## Feedstock Quality

### Minnesota LCMR Research (continued)

- Next Steps
  - Investigate pretreatment for switchgrass, wood, crop residues
  - Scale up corn stover/hog manure blends (1000 – 5000 hogs)
  - Investigate the effect of mesophilic and thermophilic conditions on enhancing methane production



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## Utility Infrastructure

- On-site energy requirements
- Utility interconnect
  - Gas Pipeline
  - Electric Grid
- Access to natural gas pipeline
- Know regulatory guidelines for site layout and byproducts handling



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## Biomass Technologies

- Anaerobic Digestion – Biogas
  - electric generation
  - boiler operation
  - pipeline quality gas
- Combustion
  - Steam production
  - electrical generation
- Gasification - Syngas
  - CT, boiler or engine Gen-set
  - pipeline quality gas



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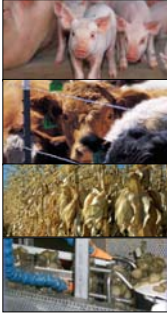
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*Biomass Technologies*

- Animal Manure
- Wood Waste
  - Sawdust
  - Wood chips
  - Slash
  - C&D debris
- Food Processing Waste
- Landfill Gas
- Distillers Grains
- Corn Stalks
- Dedicated Energy Crops




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*Biomass Technologies*

System Evolution – Anaerobic Digesters

- Simple plug flow systems to complete mix single & two stage high temperature systems
  - provide higher biogas production to increase ROI
- Goal is to reduce retention time for liquids (HRT) and solids (SRT)
  - lower capital costs and increase biogas production




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*Biomass Technologies*

- Maintain consistent conditions
- “Kick the tires”
- Talk to fellow operators
- Know implications of using substrates

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**Ideal System**

- A delivery system in which a supplier sets up a digestion system and the farmer would then pay for the service and the maintenance, *but not be required to get involved in operations.*
- Supplier could service a number of farms in a given area, with everyone aiming for 90 to 100 percent waste reduction and utilization of as many by-products as possible, including electricity, pipeline quality gas, digested solids and effluent & meet biosecurity concerns

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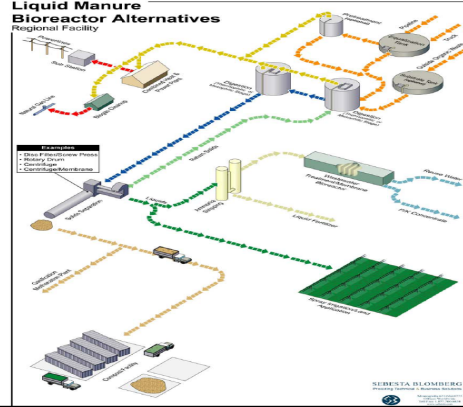
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**Liquid Manure Bioreactor Alternatives**  
Regional Facility



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- Dependent on size, type and complexity
- Define responsibilities for operation
  - Weekends
  - Troubleshooting
  - Digester upsets
- Digesters take time to startup, require outside seed materials to hasten startups.
- Engine Gensets require regular maintenance and may need biogas conditioning for high concentrations of H<sub>2</sub>S

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**Steps for Success**



- Initial Feasibility Study
- Business Plan Development
  - *Understand the Agreement*
- Preliminary Engineering
- Construction Document Preparation
- *Define Acceptance (i.e. data collection, biogas production, genset utilization, etc)*
- Construction Services
- Post Construction – Startup
  - Demonstration Testing (30-60 days prior to Substantial Completion)
  - Performance Warranty (1 year after Substantial Completion)
  - Equipment Warranties (typically 1 year after Substantial Completion)

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**Feasibility Study**



- Manure/Feedstock Characterization
- Technology Evaluation
- Effluent Evaluation
- Gas Use Evaluation
- Site Configurations and Permitting Requirements
- Funding & Investor Opportunities
- Greenhouse Gas Benefits Determination
- Economic Proforma Evaluation

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**Feasibility Study**

**Capital Cost**

- Equipment & Installation
- Shipment
- Interconnection Costs
- Site Work
- Balance of Plant
- Unknown Detail
- Engineering
- Commissioning & Start-up
- Construction Management

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*Feasibility Study*

**Operating Expenses**

Labor	Interest
Water Treatment	Depreciation
General Maintenance	Substrates
Effluent Handling	Transportation
Standby Charges	

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*Feasibility Study*

**Revenue**

- Electric buyback rate
- Biogas purchase price
- Additional credits
  - \$3 - 4/ton of CO<sub>2</sub> for carbon credits
  - Methane generally has a multiplier of 21
- Green power credits (demand / value highly sensitive to location) trading on Chicago Climate Exchange
- Renewable Energy Credits
- Federal Tax Credits ~ \$4/MMBTU




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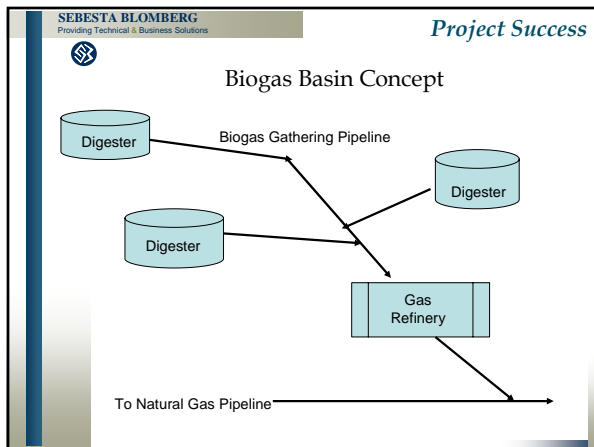
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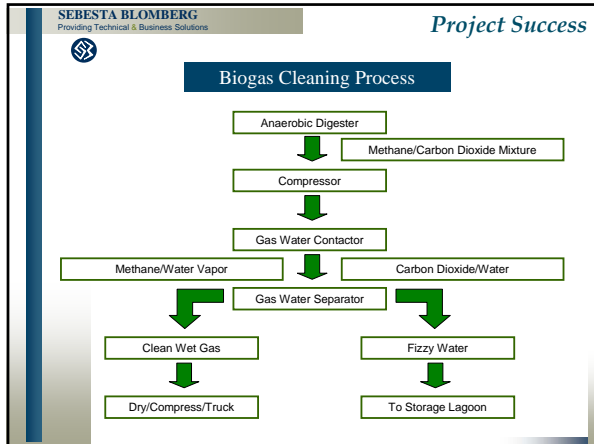
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- SEBESTA BLOMBERG  
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- Project Success*
- ### Project Status
- First digester has been running for over a year
  - Second digester is nearing one year mark
  - Gas refinery has been in continuous operation since November
  - Gas injection point under construction near Baldwin, WI

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# Thank You

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