BIOFerm™ Energy Systems

Challenges and Opportunities in Developing a Successful AD Project

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US Composting Council Conference

Content

Company Introduction

Dry Fermentation AD basics

Factors that lead to a successful project

- Project Development Timeline
- Feedstock Selection and Sources
- Technology Decision – Wet vs. Dry Fermentation AD
- Site Selection
- Digestate Use
- Energy Production
- Financing and Incentives

Case study

BIOFerm™ Energy Systems
A Company of the Viessmann Group

- BIOFerm™ is a wholly owned subsidiary of the Viessmann Group, which was founded in 1917
- Comprehensive product range of heating and climate control technology
- $2 billion worldwide company

- North American HQ in Madison, WI since 2007
- Designs and builds biogas plants
- 30 installations worldwide, 2 projects underway in US

USCC Presentation

Why Implement Anaerobic Digestion (AD) Technology?

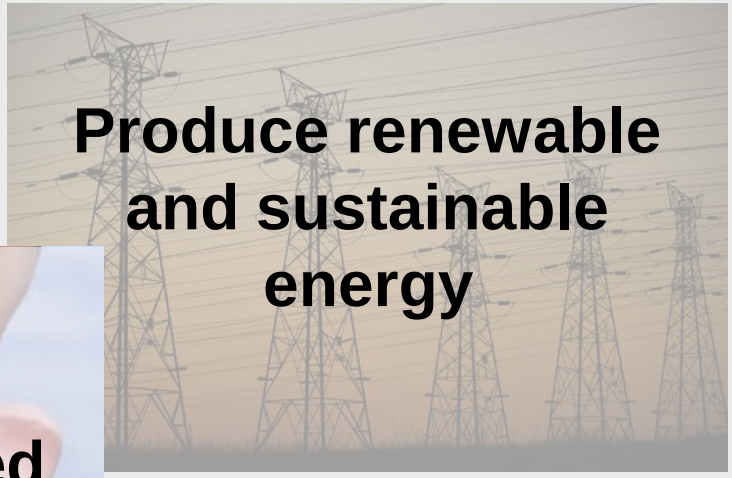
Turn organic waste into a resource

Increase your annual throughput

Accept a broader range of input materials

USCC Presentation

Why Implement Anaerobic Digestion (AD) Technology?



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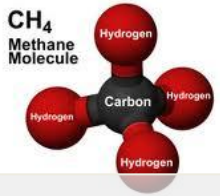
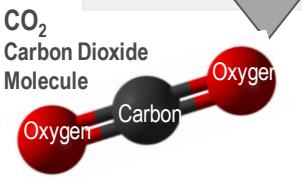
Basic AD Process Flow

ORGANIC MATERIAL

AD – BIOLOGICAL PROCESS





BIOGAS

DIGESTATE

ELECTRICITY

HEAT

NATURAL GAS

COMPOST

LAND APPLY

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Factors That Lead to a Successful AD Project

Many factors need to come together to create a successful AD project

- Project development timeline
- Feedstock selection and sources
- Technology decision – wet vs. dry fermentation
- Site selection
- Digestate use
- Electricity, heat, or natural gas sales
- Project economics and incentives

Without careful consideration of each of these factors, an anaerobic digestion facility will be very difficult to come to realization!

Factors That Lead to a Successful Project

Project development timeline

- Planning and conceptualization phase could last 6 months to over a year
- Design and permitting phase - 3-6 months
- Construction – 6 months
- Biological commissioning – 2-3 months
- Consider timeline for application for government grants at state and/or federal level and when including renewable energy tax credits in financing plan
- Work with an experienced project developer

Allow for a minimum of 2 years from conceptualization to implementation!

Factors That Lead to a Successful Project

Feedstock selection and sources

- Type of feedstock (What?)
  - Source-separated organics
  - Industrial food processing by-products
  - Yard waste
  - Agricultural waste, e.g. manure
- Feedstock Source (From where?)
  - Commercial, e.g. Restaurants, supermarkets
  - Residential, e.g. Yard waste, food waste
  - Industrial, e.g. Food processing waste
- Who?
- Collection process should be in place or planned (How do you get it?)
  - Hauling considerations
  - Receiving schedule

Secure long term feedstock contracts and consider receiving schedule!

Factors That Lead to a Successful Project

Technology decision – wet vs. dry fermentation

- Based on the feedstock characteristics, chose a suitable technology
- Pros and Cons to all methods
- Decision should be based on incoming feedstock and desired digestate
  - Solids content 25-35% = dry fermentation
  - Solids content <15% = wet fermentation
- BIOFerm™ offers technologies suited to varied feedstock composition

Choose the right technology based on the moisture content and composition of your feedstock!

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Factors That Lead to a Successful Project

Site selection

- An appropriate site is a crucial piece of the puzzle
  - Adequate size
  - Distance to waste source
  - Site characteristics: natural water ways, geotechnical conditions, etc.
  - Permits must be attainable.
  - Phase 1 and/or Phase 2 environmental study may be necessary to determine suitability of site
  - Neighbors
  - Urban sites must carefully consider odor management
  - Site ownership
  - Utility connections: distance to existing connections

Consider all these factors when looking for a site for your project!

Factors That Lead to a Successful Project

Digestate use

- Total mass will be reduced about 40% by AD process, however remaining 60% of material wet or dry must be managed
- Can add additional cost if it needs to be transported off site
- Dry fermentation produces digestate which may be processed into high quality compost
- Composting adds more value and creates an additional revenue stream for solid digestate
- Select a composting system (GORE cover, in-vessel composting, etc)
- Consider market for compost in the area.
- Liquid digestate can be used in composting process
- Drying, pelletization, combustion, or direct land application are also possible options

Establish long-term agreements for digestate or compost sales!

Factors That Lead to a Successful Project

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Energy Production

- Typically, generated biogas is utilized in a CHP (combined heat and power) unit to generate electricity and heat
- Project developer should consider where electricity and/or heat can be used or sold
  - Electricity can be fed into the grid and offset own use
  - Heat user needs to be near plant

Negotiate power purchase agreement with local utility company; can have big effect on project economics!

- Option to upgrade biogas to pipeline quality natural gas or CNG – additional process cost
- Consider cost of converting vehicle fleet

Consider the higher cost of implementing gas upgrade option!

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Factors That Lead to a Successful Project

Project Economics and Incentives

- Factors that help project economics
  - Tip fees or disposal cost offsets
  - Compost/digestate sales
  - Energy sales
- Incentives currently available to help project economics
  - Grant money available at state and/or federal level
  - 30% investment tax credit
  - Renewable Energy Credits
  - Carbon credits
  - USDA Rural Energy for America Program
  - State programs, e.g. Wisconsin's Focus on Energy

    Clean Energy State Alliance http://www.cleanenergystates.org/Funds

Keep in mind that state and federal incentives may expire before your project heads into the construction phase!

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Case study

Case Study - Feasible Project

• Project Timeline	Started conceptual phase years ago, allowed adequate timing for design, planning and permitting
• Feedstock	Waste from established organics collection that includes food and yard waste from residential collection, organic waste from commercial and industrial sources
• Technology	Dry Fermentation based on input material and desired integration with existing composting operation
• Site Selection	Purchase of property adjacent to existing operation, no heat user close by
• Digestate Use	Integrate into existing covered compost system
• Energy Use	Electricity generation with grid connection and negotiation of power purchase agreement
• Economics	- Eligible for 30% tax credit - Collect tipping fee for waste - Sell finished compost products, use liquid digestate in composting process - Sell electricity

Case Study - Feasible Project

Financial viability key to success!

• Annual organic waste volume:	50,000 tons
– At $32/ton tip fee	$1,760,000
• Average electric capacity from biogas:	2,363 kW
– At $0.08 per kWh	$1,512,320
• Average annual thermal energy produced:	64,451 MMBTU
– At $10.50 per MMBTU	$676,735
• Volume of solid digestate for composting:	36,860 cubic yds
– At $15 per cubic yard	$552,900
• Volume of liquid digestate:	4,430 tons
– At $6 per ton	$26,580
• Carbon credits from avoided emissions:	25,118 tons
– At $15 per ton	$376,770

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Case Study - Feasible Project

- Total annual revenue = $4,905,305
- Annual operating costs = $2,115,000

- Annual net operating profit = **$2,790,305**

Thank you!

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