CH4 Biogas

Green renewable energy

SWANA Presentation
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CH4 Biogas, LLC
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http://www.ch4biogas.com/

Capabilities, technology and experience
Introduction to CH4 Biogas

CH4 Biogas is a leader in US renewable energy projects

- Builds, owns and operates mixed waste biogas facilities
- Proven technology with over 40 facilities built and operating globally
- Self-financed project development and on-going operations
- Fully operational facilities within 12 months
- 30 years operating experience in successful environmental businesses

the right technology and the right team

CH4 is founded on domain specific experience

History

- In 2008, CH4 Biogas was formed by Paul Toretta, Robert Blythe, and Karsten Buchhave to pursue biogas opportunities in the US renewable energy market

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- The Company's partners bring years of pertinent experience
  - Design, build, own and operate successful environmental businesses
  - Thorough understanding of biogas renewable energy market, environmental sustainability and the waste disposal needs of producers
  - Utilizing proven Danish technology through Bigadan A/S a market leader in large scale co-digestion (www.bigadan.com)

CH4 Biogas partners with Bigadan A/S to bring a proven technology to the US market

Bigadan system features

- Digester vessel up to 2.25 million gallon capacity
- Designed to handle mixed waste streams including livestock manure, food grade industrial waste and source separated organic waste
- Pre-digestion pasteurization for bio-security
- H_2S scrubber to clean biogas
- Pumps, switch gear and controls factory assembled and containerized
- Post digestion fiber separation for nutrient management
- SCADA process controls for automatic operation

Bigadan A/S

- Pioneer of co-digestion concept that is the operating model for the Danish biogas industry
- 30 years design, construction, and operations experience
- Extensive experience with mixed waste streams
- A market leader in Europe

Co-digestion model

Co-digest organic wastes from livestock producers, food processors , retailers and institutions

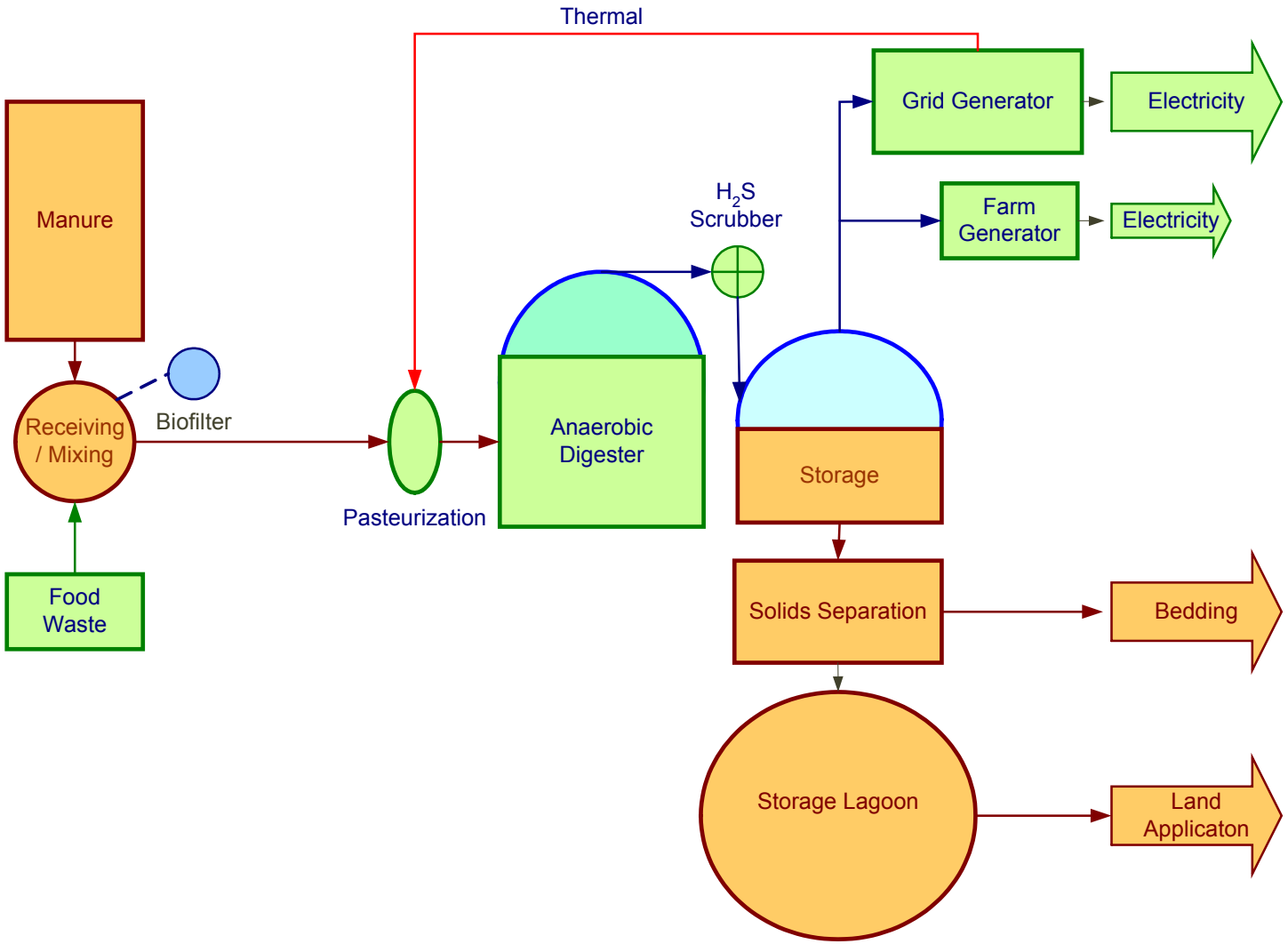
- Whey and other dairy processing waste streams
- Distillers yeast
- Inedible packaged foods
- Food processing screenings and DAF sludge
- Slaughter house waste streams
- Grocery and institutional source separated organics
- Fats, oils and grease
- Glycerin
- Livestock manure
- Spoiled animal feed
- Energy crops

Biogas used for CHP or RNG

Digested biomass dewatered to produce animal bedding and soil amendment

Liquid fraction land applied or sent to permitted WWTP

Synergy schematic



Synergy Biogas

Project Specifications

- 425 T/day mixed-waste biogas facility located on 2000 cow Synergy dairy in Wyoming County, NY
- Feedstock is manure pumped from the dairy and organic waste trucked in from regional food processors
- 1.4 MW/h generating capacity
- Electricity and REC are sold over NYISO through a broker
- Digested biomass is dewatered to produce bedding for the dairy and liquid fraction is spread on cropland

Grant Support

- Received 1603 grant March 2012
- Awarded grants from NGRID and NYSE

Status

- Fully operational

Construction process

- Concrete foundation pads are laid for each of the tanks and containers
- Digester foundations will require piling in NC

- Digester top and first ring are stainless steel
- Jack system raises completed rings as tank is assembled

Arrival of containers and equipment

- Equipment arrives ready for assembly
- Pumping containers and engine containers are shipped ready for installation

Mechanical and installation

- Counter-flow heat exchangers

- Insulation and siding are added to the digester once the tank has been assembled

Synergy Biogas Facility

Systems designed for co-digestion

- Receiving
  - De-packaging and pre-processing
  - Capacity to equalize delivery schedules
- Pasteurization
- Complete mix digester vessel
- Management of digested biomass
  - Dewatering of digested biomass
  - Storage and seasonal land application

US biogas market opportunities

Livestock Producers

- Anaerobic digestion is basis of environmentally superior manure management for US livestock producers
  - USDA estimated 335 million tons of dry manure per year from US farms
  - US methane emissions from livestock manure management accounts for ~ 10% of total US methane emissions

Food Processors

- Food processors have site specific needs (across hundreds of US sites)
  - Residual/waste management to reduce carbon footprint and improve operations
  - Renewable energy for long term price stability

Regional Waste to Energy

- Diversion of organics from landfill disposal and tighter land application rules
  - EPA estimates 33 million tons of food waste end up in landfills and incinerators annually
- Compliance with RPS mandates
  - Over half of the states have a renewable energy mandates

US Market Drivers

Head winds

- Low energy prices
- ITC uncertainty
- Low cost disposal options for food waste
- High interconnection costs

Tail winds

- Renewable and carbon initiatives from private sector
- State level RPS programs
- State level waste diversion programs
- Project financing opportunities

Thank you

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