Anaerobic Digestion of High Solids Organic Material

Solid Waste & Recycling Conference
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John McDowell, Sales Engineer – Biogas Solutions
Agenda

Introduction

Extracting Value of Organic Waste using Anaerobic Digestion

High Solids Digestion

Project Profile
Eisenmann USA

- Located in Crystal Lake, Greater Chicago Area
- Over 37 Years in the US
- Over 1000 industrial installations in the US
- ~ 80 employees (3700 globally)
- Sales, Engineering, Design and Services
- Over 90 biogas installations worldwide
Extracting Value from Organic Waste with Anaerobic Digestion
Current State of National Organics Recovery

Figure 5. Total MSW Generation (by material), 2011
250 Million Tons (before recycling)

- Yard trimmings 13.5%
- Food waste 14.5%
- Other 3.3%
- Wood 6.4%
- Plastic 12.7%
- Rubber, leather & textiles 6.2%
- Paper & paperboard 28.0%

Figure 6. Total MSW Recovery (by material), 2011
87 Million Tons

- Yard trimmings 22.2%
- Paper & paperboard 52.8%
- Other 5.3%
- Food waste 1.6%
- Wood 2.7%
- Glass 3.7%
- Plastics 3.1%
- Metals 8.6%

Source: EPA
Waste Audits

Conducting a waste audit or evaluation

Sources: MIT and Tim Horton
Anaerobic Digestion Process

Organic material is delivered to the digester system

Organic material is broken down in a digester

Some biogas can be used to heat the digester.

Raw biogas is processed

Processed biogas is distributed and used

Liquids and solids may be separated.

Digested material is processed and distributed

Liquids

Solids

Full Graphic: http://americanbiogascouncil.org/pdf/adOverview.pdf
Solids Content and Handling of Feedstock

What kind of digester do I need?

→ Typical Approach: High solids or Low solids?
Solids Content and Handling of Feedstock

What kind of digester do I need?

How can I handle the feedstock - pumping or stacking?

- Low Solids: Pumpable
- High Solids: Stackable
High Solids Digestion
Mixed Horizontal Plug Flow Schematic

- Substrate Conditioning
- Substrate Feed
- Solids Separation
- Main Digester
- Pump Room
- Post Digester
- Biogas Consumer
Substrate Conditioning - Grinding

Quick grinding of larger size, inhomogeneous substrates

- Suited for yard and landscape waste
Substrate Conditioning - Screening

Loosening, sieving, transport, removal of oversize contaminants

- Suited for green bin, yard, and landscape waste
Substrate Conditioning - Hammermill

Substrate is macerated and homogenized with hammermill
Organic material is macerated; packaging and contaminants are separated

- Suited for packaged pre- and post-consumer food waste and slaughterhouse waste
Substrate Feed System - Solids

Provides buffer storage of conditioned, high solids organic waste

- Suited for stackable and bulk materials
Substrate Feed System - Liquid

Receiving pit and/or tanks for liquid organic materials
Receives and provides buffer storage

- Suited for all pumpable organic material
Maximizing Biogas Production
Digestate Handling

Hose pumps used to remove and convey digestate from main digester vessel

Suction pump with less wear parts and easy maintenance

- Suited for digestate with lumpiness and high viscosity
Solids Separation

Screw press separators remove non-digestible solids

- Press cake – 30-35% total solids
- Press water – 8-20% total solids
Post digester

Covered vessel for residual gas production

Size varies depending on storage requirements

Submersible mixers

Double membrane gas storage
Output – Biogas

Combined Heat and Power Unit (CHP)
- Electricity: on-site or fed into utility or micro grid
- Thermal energy: heat digestion process or industrial processes

Biogas Upgrading Unit
- Fed into utility pipeline system (RNG)
- Utilization as vehicle fuel (CNG or LNG)
Output – Digestate

The nutrient-rich solid and liquid digestate can be a valuable co-product.
Considerations

Feedstock
- Solids content and handling
- Quantity / Feedstock agreements

Output
- Use of biogas and digestate
CR&R Biogas Case Study
- Organic Waste to Vehicle Fuel
## Extracting Value from Organic Waste

<table>
<thead>
<tr>
<th></th>
<th>Landfill with Gas Collection</th>
<th>Composting</th>
<th>Anaerobic Digestion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emissions Reduction</td>
<td>✅</td>
<td></td>
<td>✅</td>
</tr>
<tr>
<td>Energy Generation</td>
<td>✅</td>
<td></td>
<td>✅</td>
</tr>
<tr>
<td>Nutrient Recovery</td>
<td></td>
<td>✅</td>
<td>✅</td>
</tr>
<tr>
<td>Cost of Disposal</td>
<td>Lower</td>
<td>Middle</td>
<td>Higher</td>
</tr>
</tbody>
</table>
CR&R Anaerobic Digestion Project

Perris, California – Phase 1

CR&R Environmental Services

~50 Municipal Contracts

> 2.5 Million Customers

Feedstocks

High Solid Yard and Food Waste

Throughput

229 Tons per Day

~ 80,000 Tons per Year

(Over 300,000 Tons per Year in 2020)

Biogas / CNG Production

~ 1,000,000

Diesel Gallon Equivalent (DGE) per Year
CR&R Project Benefits

- Diverting green waste to biogas plant reduces emissions of green house gases
- CNG to fuel fleet of collection vehicles
- Digestate will be used as soil amendment or composting

“After a worldwide search, Eisenmann’s anaerobic digestion system stood out as the only technology that was able to provide the highest possible conversion rates for the broadest range of feedstocks.”

Mike Silva, CR&R Organics Processing Project Leader
Contact

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Additional Slides and Information
Municipal Biogas Plant

| Built:  | 2010 |
| Location: | Switzerland |
| Substrate: | manure, post consumer foodwaste from green bin collection, yard waste, food manufacturing waste |
| Capacity: | 12,000 t/yr |
| Digester size: | 212,000 gallons |
| Biogas flow: | 88 CFM |
| Installed electrical capacity: | 330 kW |

*Main and post digester* *Biogas piping*
Biogas Plant with Pushfloor Delivery

Built: 2012
Location: Sweden
Substrate: post consumer food waste from green bin collection, yard waste

Capacity: 20,000 t/yr
Digester size: 2 x 212,000 gallons
Biogas flow: 153 CFM
Biogas upgraded to CNG, used to fuel public transportation vehicles
Anaerobic Digestion Process – Overview

- Food Waste
- Green Waste

- Receiving Area
- Pulper/Grinder
- Screening System
- Biogas Separator
- Main Digester
- Walking Floor Container
- Post Digester / Storage
- Biogas

- Liquid Fertilizer
- Liquid Effluent
- Press Cake
- Composting

- Biogas Upgrading

Colors:
- Substrate Receiving
- Substrate Preparation
- Substrate Dosing
- Biogas
- Digestate

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Promoting the Use of Biogas

- 208 Members from the U.S., Germany, Italy, Canada and the UK
- All Industry Sectors Represented

Key Industry Goals:
- Promote biogas markets, technologies and infrastructure
- Achieve policy parity
- Promote as a best practice for environmental stewardship and greenhouse gas reduction

www.americanbiogascouncil.org
Changing the Biogas Industry through:

- Legislative and Regulatory Affairs:
  - **Federal:**
    - Favorable language in **Farm Bill**
    - Introduction of **Biogas Investment Tax Credit** (Rep. Kind and Rep Lewis)
  - **States:** 8 separate organics recycling legislations

- Sharing Expertise:
  - Specialized Working Groups

- Marketing and Education:
  - Briefings, presentations, and webinars for customers, policy makers, and the general public

- Member Exposure
  - Speaking opportunities in ABC workshops, webinars
  - Large Industry Network – 6,000+ member company contacts
  - Entire supply chain of production, processing and use

**Join Today!**

**Contact Josh Lieberman at jlieberman@ttcorp.com or 202-640-6595 x 322**

[www.americanbiogascouncil.org](http://www.americanbiogascouncil.org)
Dedicated to maximizing the production and use of biogas from organic waste

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