Food Waste Digestion Pilot Project at Goleta Sanitary District

CASA / CWEA

Innovative Technology Seminars

Oakland, CA – September 11, 2019
Los Angeles, CA – September 17, 2019

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Jim Dunbar, PE – Lystek International Ltd
Agenda

- Project Background
- Project Overview
- Equipment Overview
- Preliminary Results
Project Background

California must divert 20 million tons of organic waste by 2025

1. Waste reduction
2. Build new anaerobic digestion facilities, standalone or on-farm
3. Leverage existing excess anaerobic digestion capacity at water resource recovery facilities (WRRF)
4. Build new compost facilities
Co-Digestion at WRRF

Benefits

- Existing infrastructure with excess capacity
- Increased biogas production
- Onsite expertise
- Tipping fees

Challenges

- Contaminants (clogging, toxicity...)
- Grit buildup
- Odor management
- Permitting
- Clogging (FOG, struvite, contaminants...)
- Increased solids production
- Minimize transport
Project Funding

California Energy Commission

Electric Program Investment Charge (EPIC) Program


Group 3: Demonstrate and Evaluate Environmentally and Economically Sustainable Food Waste Biomass-to-Electricity Systems

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<tbody>
<tr>
<td>Energy Commission Funds</td>
<td>US$1.6M</td>
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<tr>
<td>Lystek Match Funds</td>
<td>US$1.5M</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>US$3.1M</strong></td>
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Project Timeline

• **Project Preparation**
  - Site use agreement
  - Equipment fabrication and purchase agreements
  - Permitting (CEQA, LUP & Air Permit)
    - May 2018
    - June 2018
    - Nov 2018 (CEQA) and May 2019 (ATC)

• **Design and Construction**
  - Engineering & Procurement
  - Fabrication
  - Shipping
  - Field installation
  - Commissioning and startup
    - July-August 2018
    - September-December 2018
    - March-April 2019
    - June-July 2019
    - **July-September 2019**

• **Operations, Data Collection and Analysis**
  - 2019-2020
Project Location

Source-separated food waste from Dining Commons at UC Santa Barbara

1 mile

Pilot Project at Goleta Sanitary District
System Overview

SSO Receiving Pit

Depackaging

Boiler

Thermal Hydrolysis Reactor

Final Product Storage Tank

Centrifuge

Small Agitated Feed Tank

Two 8 m³ Anaerobic Digesters

Digestate Holding Tank

Flare
Depackaging

Hammermill system with screen

FEEDSTOCK
Food waste from UCSB

REJECTS
Inorganic packaging materials, etc.

PRODUCT
Clean organic slurry 15-30% solids <1% contamination
First SSO Delivery (6 tons)

August 27, 2019

Lessons learned:
• Large load
• Plastic bags challenge
• Slurry at 18% TS

About 1.5 tons of SSO processed and fed to the digesters over 1 week.
Second SSO Delivery (2 tons)

~50% contamination in incoming load

After manual sorting

September 3, 2019
## Preliminary Results

**Food waste slurry produced by Smicon depackaging unit**

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<tr>
<th></th>
<th>TS</th>
<th>TVS</th>
<th>TN</th>
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<tr>
<td>Test run</td>
<td>12%</td>
<td>9.6%</td>
<td>2,100 mg/kg</td>
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<tr>
<td>1st load</td>
<td>19%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2nd load</td>
<td>11%</td>
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TS: Total Solid, TVS: Total Volatile Solid, TN: Total Nitrogen

Food waste slurry in the feed tank
Anaerobic Digesters

- Two 8-m³ mesophilic anaerobic digesters

Objectives:

- Stable digester operation with at least 65% VS reduction
- Biogas production with steady >60% methane concentration
- Higher biogas yield per ton of incoming feedstock than current biogas production at GSD
Preliminary Results

Anaerobic Digestion

• Digesters seeded with GSD sludge on 8/26/2019
• Food waste slurry addition started 8/27/2019

• Loading rate per digester:
  ➢ Week 1: 0.35-0.5 gal/hr (~20 lb COD/d)
  ➢ Week 2: 0.9 gal/hr (~33 lb COD/d)

The digesters are in good health:
  ➢ pH 6.9 - 7.1
  ➢ T 98.5 F (37°C)
  ➢ H₂S 50 ppm
  ➢ Biogas Evidence of biogas production but no flow meter reading yet (expect 0.1 cfm per digester)
Thermal Hydrolysis (THP)

**THP Reactor**
- Volume = 1.5 m$^3$
  - High-speed shearing
  - Alkali addition (pH = 9.5)
  - Low T & low P steam

**As a Pre-Digestion Step or with Recirculation to AD**
- Increased VS destruction
- Increased biogas yield

**As a Post-Digestion Step**
- Nutrient-rich biofertilizer
- Homogeneous & fully pumpable liquid
- High solids (15-17% TS)
- Class A with unrestricted use (pathogen-free)
Potential Issues and Solutions

- **Very contaminated loads** (~50%) (large plastic bags, bags in bags)
- **Food waste degrades quickly.** Acidification and loss of organic matter during storage pre-digestion.
- **VFA accumulation and pH drop**
- **Ammonia buildup and inhibition**
- **Heavy metals toxicity**
- **Foaming**
- **Bag opening / sorting prior to processing**
- **Process food waste within 2 or 3 days after receiving**
- **Monitor 6.8 < pH < 7.2**
- **Monitor VFA/Alkalinity ratio < 0.4**
- **Provision for sodium carbonate and bicarbonate addition to digesters**
- **Measure total nitrogen in incoming food waste to help predict ammonia generation in digester**
- **Monitor ammonia concentration in digester < 1500-2000 mg/L**
- **Monitor heavy metals concentrations in digester**
- **Provision for antifoam addition**

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Thank you!

Questions?