Food Waste Anaerobic Digestion Demonstration Program at the Joint Water Pollution Control Plant

SUSTAINABLE SOLID WASTE MANAGEMENT
FUTURE ROADMAP IMPLEMENTATION
Regional Countywide Subcommittee Meeting

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Sanitation Districts of Los Angeles County

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What we’ll talk about today...

- Policy Drivers in California
- Background & Objectives
- Processing & Receiving
- Results to Date
- Lessons Learned
Policy Drivers

- AB 341 establishes a statewide solid waste recycling goal of 75% by 2020
- CARB AB32 scoping plan establishes approaches to GHG emission reductions
- AB1826 established mandatory commercial organics recycling starting in 2016
- Organic waste estimated at 6-7 million tons per year statewide, 3 million tons in Southern California
What this Demonstration is about.

- In 2013, the Districts and WM entered into a multi-year demonstration program Agreement. Operations began in Feb. 2014

- WM sources and processes food waste at its Orange County facility, producing an Engineered BioSlurry (EBS™)

- WM deliveries up to 84 WTPD (~20,000 GPD) of EBS™ to JWPCP for co-digestion in a designated, full scale test digester (#16)

- EBS™ is fed into the test digester at a controlled rate.

- WM and JWPCP’s Research team monitors the program to evaluate the impacts and performance of the co-digestion process.

- Results will be used to determine the feasibility of a full-scale food waste AD program at Districts WWTPs
Food Waste AD Options

- Two main types of food/organic waste anaerobic digesters:
  - **Dry** TS > 15%. Best if feedstock high in green waste up to 50%, needed to stack in digester.
  - **Wet** TS < 15%. Best if feedstock has no green waste, can be pumped & mixed in digester.

- Dry FW AD digestion generally requires larger and adjacent composting area, provides lower biogas yield, and produces more solid digestate.

- Wet FW AD digestion generally provides better mixing and digestion, higher biogas yields, good odor control, and lower O&M costs.

- Co-digestion ...The digestion of multiple organic wastes in one digester such as our demonstration program where food waste is mixed with sludge at JWPCP.
Types of Organic Municipal Waste

- **Suitable for WWTP co-digestion**
  - Source separated and processed food waste
  - Fats oils and grease (FOG)

- **Not suitable for WWTP co-digestion**
  - Green waste
  - Mixed waste
Why Co-digestion of Food Waste at WWTPs may make sense

● Advantages:
  – Digester and associated infrastructure already exists
  – Energy recovery equipment may already exist
  – Assists WWTPs to become net energy producers

● Concerns and challenges:
  – Limited capacity statewide – a niche, not a solution
  – Can accept only relatively clean feedstock
  – WWTPs have an important public health mission
In 2011, Districts completed a feasibility study on co-digestion of food waste at Districts WWTPs.

Conclusion...we had a viable project at JWPCP.
- It is technically feasible (economics still a question)
- It is allowed under current regulations
- It could assist L.A. County cities/haulers with diversion efforts

In 2012, performed bench scale testing of co-digestion of FW slurry and JWPCP sludges...
- Characterized FW slurry (developed FW specifications)
- Identified no negative impacts on digester operation
- Quantified biogas production potential
Adding Food Waste to Bench-scale Digesters Increases Gas Production

Adding 10-12% (v/v) food waste slurry to sludge could double biogas production

Food Waste Slurry characteristics: Total Solids ~ 14% by wt., Volatile Solids ~ 92% by wt., COD ~ 222,400 mg/L
Joint Water Pollution Control Plant

- 24 active digesters each with capacity of 3.7 million gallons
- 4.4 million gallons of sludge is added to digesters each day
- Volatile solids breakdown (digest) for 18-19 days before exiting digester
- 5,000 scfm (or ~ 20 MW) of biogas is created
- Remaining biosolids are dewatered and trucked off for use in composting and for land application
JWPCP Total Energy Facility

Combined Cycle Cogeneration Power Plant

- (3) 9 MW Solar Turbine Mars 90’s gas turbine generators
- (1) 8.7 MW Shin Nippon Machinery steam turbine-generator
- 20 MW used to meet on-site load

2012 Grand Prize Winners – Operations Management
AAEE Excellence in Environmental Engineering and Science
Demonstration Project Objectives

- Assist Districts member cities and haulers in diversion efforts

- Determine the impacts of full-scale food waste co-digestion on WWTP operations

- Evaluate the performance and cost-effectiveness of food waste co-digestion at a WWTP

- Use project results to determine feasibility of a larger food waste digestion program at Districts wastewater treatment facilities

Video up next
Click here for video
WM’s CORe® Facility in Orange

**CORe®** *(Centralized Organics Recycling equipment)*

- WM collects food waste from sources such as restaurants, food processing plants, and grocery stores. Tipped material is inspected prior to processing.

- Food waste is processed to remove physical contamination (e.g., utensils, cans, packaging, and heavies) and blended into a consistent EBS™ product.

- EBS™ is loaded into tanker trucks for delivery to JWPCP.
EBSTM Receiving at JWPCP

EBSTM is pumped from WM tanker trucks into closed, sealed storage tanks, controlling odors.

Two identical receiving/feed-in stations for redundancy.
**EBSTM Feed-in Station**

- **EBSTM** is recirculated (mixed) in the storage tanks on an intermittent basis to remain “fresh”

- **EBSTM** is pumped from storage tanks into the top of the test digester

- **EBSTM** is fed to the test digester at a feed rate set by the control program

- WM and Districts remotely monitor feed-in station operating parameters including storage levels, pump speed, mixing times, and feed in rates.
## Food Waste Co-Digestion Plan

<table>
<thead>
<tr>
<th></th>
<th>Test Digester</th>
<th>Control Digesters</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WW/Sludge/TWAS Feed</strong></td>
<td><strong>gal/day</strong></td>
<td><strong>gal/day</strong></td>
</tr>
<tr>
<td>% solids</td>
<td>3.20%</td>
<td>3.20%</td>
</tr>
<tr>
<td>tons per day solids</td>
<td>27.3</td>
<td>27.3</td>
</tr>
<tr>
<td><strong>Food waste slurry feed</strong></td>
<td><strong>gal/day</strong></td>
<td>---</td>
</tr>
<tr>
<td>% Solids</td>
<td>14%</td>
<td>---</td>
</tr>
<tr>
<td>tons per day solids</td>
<td>11.7</td>
<td>---</td>
</tr>
<tr>
<td><strong>% Food Waste</strong></td>
<td>liquid basis</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>9%</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>solids basis</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>30%</td>
<td>---</td>
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<tr>
<td><strong>Digester total</strong></td>
<td><strong>gal/day</strong></td>
<td><strong>gal/day</strong></td>
</tr>
<tr>
<td>% Solids</td>
<td>4.2%</td>
<td>3.20%</td>
</tr>
<tr>
<td>HRT, days</td>
<td>16.4</td>
<td>18.0</td>
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</table>
Project Results – Gas Production

8-Week Rolling Average

Digester Gas Production, cfd

Control Dig.  Test Dig.

Food Waste Addition Started

Dec-13  Feb-14  Apr-14  Jun-14  Aug-14  Oct-14  Dec-14  Feb-15  Apr-15
Projected Digester Gas Production

- Control Digester Gas Production
- Test Digester Gas Production at 7,000 gpd food waste
- Test Digester Gas Production at 20,000 gpd food waste

Digester Gas Production, cfd
- Control Digester Gas Production: 371,000
d- Test Digester Gas Production @ 6,500 gpd EBS™: 455,000
d- Test Digester Gas Production @ 20,000 gpd EBS™: 600,000
## Performance of Digesters
### 4-Week Average as of March 7, 2015

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>Control</th>
<th>Test</th>
<th>% Change</th>
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<tbody>
<tr>
<td>EBS™ Feed Rate</td>
<td>gpd</td>
<td>0</td>
<td>6,500</td>
<td>---</td>
</tr>
<tr>
<td>Digester Gas</td>
<td>cfd</td>
<td>371,000</td>
<td>455,000</td>
<td>23%</td>
</tr>
<tr>
<td>Methane</td>
<td>%</td>
<td>62.5</td>
<td>62.5</td>
<td>0%</td>
</tr>
<tr>
<td>Digester Gas H₂S</td>
<td>ppm (v/v)</td>
<td>27</td>
<td>30</td>
<td>11%</td>
</tr>
<tr>
<td>VSD</td>
<td>%</td>
<td>51.9</td>
<td>63.8</td>
<td>23%</td>
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<tr>
<td>Digester Gas/lb VS</td>
<td>cf/lb</td>
<td>8.92</td>
<td>9.11</td>
<td>2%</td>
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</table>
Use of DG from Food Waste

- Potential usage of digester gas from 84 tpd EBS™
  - 200 scfm at 60% methane
  - 1,500 GGE/day CNG
  - 750 kW

- Current usage of digester gas
  - TEF uses additional digester gas to generate extra electricity for sale when excess digester gas is not being flared
  - If all the gas could be used (non-flaring days), current digester gas production of 100,000 cfd of digester gas from EBS™ can produce an additional 270 kW.
Lessons Learned & Takeaways

- Early on, EBS™ transport, transfer and control systems at LACSD had issues. Issues resolved and now work as intended.
- The original odor control system (biofilters) could not handle the high level of H2S generated from EBS™ storage. Switched to carbon filter canisters. ...no further issues
- There have been no major impacts to treatment plant operation or digester operations seen to date. All indicators look good.
- Biogas production levels from EBS™ has met expectations.
- Finding suitable sources of Food Waste has been more challenging than originally envisioned, and has delayed increased ramp up of EBS™ to the test digester.
New Wet Dry Food Waste Collection System

- Cutting Edge
- Neighborhood-Friendly
- Low Capital Cost
“So, this Humpty Dumpty guy falls off the wall and I think, Dang, ain’t lettin’ this go to the food waste bin.”