Co-Digestion of food wastes at wastewater treatment plants

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Overview of presentation

- Introduction
- Example co-digestion facilities
- Potential benefits
- Potential challenges
- Wrap-up
Introduction
Options for Handling Waste

- Disposal at Landfill
- Recycling
- Source Separated Organics Processing
- Mixed Waste Processing
- Thermal Technologies
- Mechanical Biological Treatment
- Composting
- Anaerobic Digestion (AD)
Recycling Target for Florida

Florida DEP’s 75% Recycling Goal

- In 2008, Florida established a new statewide recycling goal of **75% to be achieved by the year 2020**
- Targets municipal solid waste including wastes from residential, commercial, and institutional sectors
- Statewide recycling rate **currently 50% (2014)**

http://www.epa.gov/solidwaste/nonhaz/municipal/hierarchy.htm

Reduce, Reuse, Recycle, “and Recover”
Introduction to co-digestion of food waste at a WWTP

- Solid waste industry looking to increase diversion of food waste
- Wastewater industry seeking to minimize energy consumption and operating costs at WWTPs
- Can we take food waste out of the landfill and use it to minimize energy consumption and operating costs at a WWTP?

INCREASED SUSTAINABILITY
**Basics** of anaerobic digestion

- Biologic degradation of materials in the absence of oxygen
- Produces a biogas
  - generate energy
- Produces digestate
  - Liquid: re-circulated or used as a liquid fertilizer
  - Solid: typically requires aerobic composting for full biostabilization
- Anaerobic digestion used in both treatment of wastewater sludges and food waste
Example facilities
East Bay Municipal Utility District (EBMUD)

- 168 MGD capacity with AWDF of 60 MGD, 22 MGD AD capacity
- First WWTP in NA to become net energy positive in 2012
- Invested $35 million, 3.2 year simple payback
- Source of organics:
  - FOG
  - Winery waste
  - Industrial liquids and solids
  - Animal processing & rendering
  - Post-consumer commercial
  - Post-consumer residential (pilot)

The East Bay Municipal Utility District patented food waste processing system. The system removes contaminants from food waste and creates a homogenous, energy-rich slurry, which is anaerobically digested to produce methane (renewable energy) and a soil amendment or fertilizer.
West Lafayette, Indiana

- 10.5 MGD activated sludge plant, 2 mesophilic digesters
- 2x 65kW microturbines (2009)
- Sources of organics (1-2 tons per day):
  - Fats, Oil, and Grease (FOG)
  - Food Waste from Purdue University Dining Courts
  - Vegetable waste from Purdue’s agricultural research
  - Spoiled produce from local Food Bank

- Generates up to 20% of electricity needs
- 40% reduction in natural gas usage
- 12 year simple payback

Potential benefits
Potential benefits

- Many WWTPs have anaerobic digesters with **spare capacity**
- On-site digester **operating expertise** at WWTPs
- WWTPs **located in urban areas where food waste is** generated:
  - Reduced transportation costs
  - Reduced site development costs for new waste processing facility
- Increased volatile solids destruction, reducing biosolids volumes and management costs
- **Energy generation** potential
- Digesting food waste prior to composting reduces emissions of volatile organic compounds (VOCs), which contribute to air pollution
Energy use at WWTPs

- WWTPs in US use approximately 30.2 billion kWh per year, or about 0.8% of national electricity use
- Water and wastewater utilities are typically the largest energy consumers in municipalities, often accounting for 30-40% of total energy consumed by municipal governments
- For WWTPs, energy bills can be ~30% of total operation and maintenance (O&M) costs, usually representing a facility’s second or third biggest expense

Source: EPA/600/R-14/240 September 2014
Collection is expensive

Source: CCME, 2014. State of Solid Waste Management in Canada
Single vs. multi-family

- Single detached homes are on the decline in many jurisdictions across the US and Canada
- Gap in diversion rates between Single Family Homes and Multi-Family Homes
- More recyclable/organic material moving to a harder to capture housing market
Garbage disposals

• **Potential** opportunity to further reduce transportation costs and increase food waste capture from multi-family
• Further pre-processing would not be required at WWTP
• Wastewater collection infrastructure needs to be evaluated to be sure it can accommodate the ground-up food waste
Potential challenges
**Potential challenges**

- Physical contamination in food waste
  - grit and solids accumulation in digesters, biosolids quality
- Limit to how much food waste can be added (approx. 20%)
  - Foaming and sludge blanket formation
  - Hydrogen sulfide ($\text{H}_2\text{S}$) | odor and corrosion concerns
Pre-Treatment technologies

- Bag opening
- Mechanical sorting
- Manual sorting
- Grinding/Shredding
- Press
- Pulper
- Grit Removal
- Hydrolysis
Bag opening

- Open bags, limited shredding
- Can be integrated in other units (e.g. hopper, metering bin)
**Mechanical** sorting by size

**Trommel**

**Vibrating Screen**
Manual sorting
De-packaging
Grinding or shredding
Press – wet/dry separation
**Pulper** - density separation

- **Raw SSO**
- **Rake**
- **Residue**
- **Pulp**
- **Heavies**
“Lights” from pulper
“Heavies” from pulper
Pulp from Pulper
Tiny grit, big problem
Grit removal

Gravity separation
Grit removal

Dynamic Cyclone  Hydrocyclone
In-Tank contaminant removal
Thermal hydrolysis
Wrap-up
Closing

Co-digestion is only feasible under a specific set of conditions, but if those conditions are present, leveraging assets at local WWTPs can be an attractive and cost-effective means of implementing or expanding an organics diversion program.
Co-Digestion Economic Analysis Tool (CoEAT)

USEPA Tool
Questions/Contacts

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