Net Zero at the Danbury, CT WPCF

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Danbury, CT WPCF

- Annual average flow \approx 9 MGD
- \approx 14 dry tons of solids pre-digestion



How the Project came together

City

Need to address Fats, Oils, and Grease

Veolia

- Looking at ways to reduce operating expenses at the Plant
- Anaerobic Digestion energy potential, nutrient recovery

Wright – Pierce

Engineering Assistance

What is FOG?

Solid at room temperature

FATS

Liquid at room temperature

OILS

Butter, shortening, margarine Peanut butter Meat trimmings Uncooked poultry skin Dairy: Cheeses, milk, cream, sour cream, Ice cream Vegetable oil Canola oil Olive oil Corn oil Salad dressings Cooking oils Turns to liquid during cooking, but solidifies when cooled

GREASE

Gravy Mayonnaise Melted meat fat Bacon and sausage Boiled poultry skin Salad dressing

Where Does FOG Come From?

Restaurant/Food Processing

- Yellow FOG: Collected and used for biodesiel
- Brown FOG: Not collected and enters sanitary sewers
- Industrial Waste
 - Petroleum based discharges typically contained by pretreatment programs





FOG – The Bad

- Clogs wastewater collection systems
- Contributes to collection system back-ups



Hardened fats, oils and grease clogged a larger sewer pipe.



FOG – The Bad

- WWTP foaming and coating of equipment
- Decreased plan performance and increased maintenance



FOG – The Good

- There's a lot of it: ~18.7 gal/cap/year
- High biogas yield energy potential

FOG – The Good



Adapted from Shen, Linville, Urgun-Demirtas, Mintz, & Snyder, 2015, p. 355

Codigestion with FOG

- Codigestion use of FOG and sludge blend within anaerobic digester for biogas production
- Codigestion with FOG Increases the biogas production of the anaerobic digesters
- Increases sludge breakdown



Cogeneration

 Cogeneration – simultaneous generation of electricity and heat

 Goal of Cogeneration – produce heat for onsite buildings and produce electricity for power requirements. Excess energy generation can be sold back to the grid.

Multi-Phased Project



Goal of Net Zero

- Requiring minimal outside power supply
- Heating plant with biogas
- Generating electricity with biogas
- Potentially selling energy generated with biogas back to the grid (net positive?)



The Path Forward

- Increase Capacity of Existing Anaerobic Digestion Process
- Install FOG receiving system
- Co-digesting
- Install the Cogeneration process
- Co-generation
- Net Zero
- Net Positive?

Incentives

- Low Interest Loans
 - IRS Clean Renewable Energy Bonds (CREBs)
 - IRS Qualified Energy Conservation Bonds (QECBs)
 - USDA Bio-refinery Assistance Program
- Tax Incentives
 - PURA/Eversource LREC (low emissions)
 - New England Power Pool Renewable Energy Credits

Project Economics

7 year pay back period

- Assumes only 1,000 GPD of FOG received
- Increased FOG receiving will decrease payback period

Can be variable based on current incentive programs

Increase Capacity of Existing Anaerobic Digestion Process

- 2 Digester Complexes
 - Complex 2 inoperable due to failed cover
 - Complex 1, functional, but in need of maintenance
- Complex 2 is larger and has more capacity than Complex 1



Roof Demolition – Secondary Digester Complex 2



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Roof Demolition – Secondary Digester Complex 2

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Membrane Roof Installation

- Gas membrane cover
 - Cheapest of all solutions
 - Provides biogas storage
- Design-Build
 - Veolia/Wright-Pierce/CH Nickerson



Membrane Roof Installation



Membrane Roof Installation





Membrane Roof Installation





Primary Digester - Complex 2

- New linear motion mixer replacing compressed gas mixing system
- Low energy, high efficiency mixing
- Increase Anaerobic Digester performance
- Currently under review



Next Steps

- Install Linear Motion Mixer
- Install temporary FOG receiving station (Phase 1)
 - Begin Co-Digestion verify if objectives are being met
- Install larger FOG receiving station
 - Upgrade Digester Complex 1 LMM
 - verify if objectives are being met

Next Steps – Co-Generation

- Gas Cleaning system
- Cogeneration system
 - Produce electricity
- Waste Heat
 - Heat for buildings
 - Heat for Digesters
- Net Zero



Questions / Discussions