



# Startup of Virginia's Newest Organics Co-Digestion Facility

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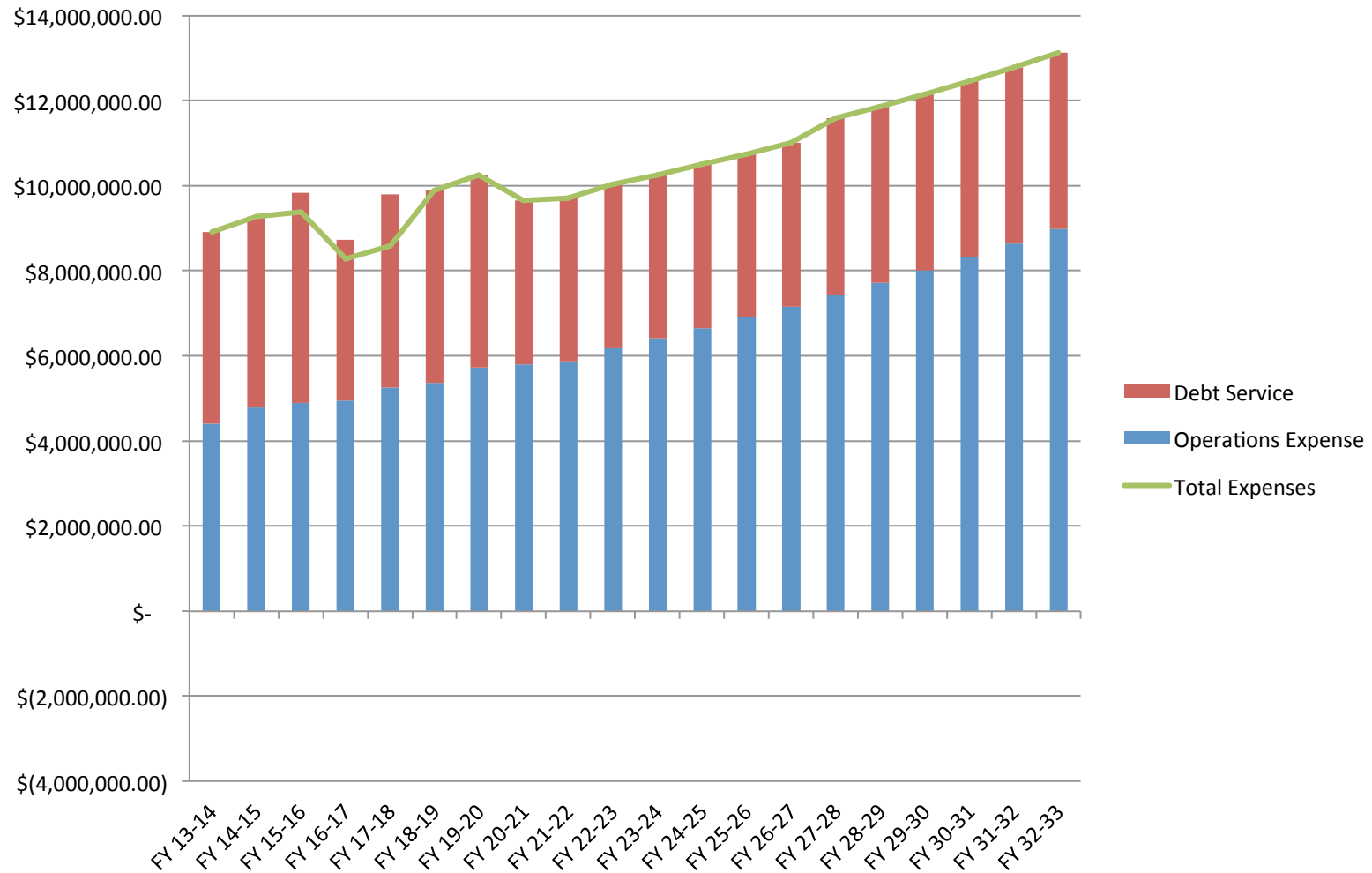


Winchester 🍏 Virginia





# FWSA – the Next 20 Years



# Objectives

- Create future rate stability (predictable rates) and annual costs (O&M, Debt Service, CIP needs) that are significantly less than now.
- Address existing and identified Capital Improvements.
- Supports community economic growth.

## Green Energy Project

New Electric  
Primary Service

Ostara™ Phosphorus  
Recovery System

Potable Water  
Treatment System

Organics  
Receiving Stations  
and Truck Scale

High Efficiency  
Lighting Systems

Rebuild & Replace  
HVAC

3 - 1.25 MG  
Anaerobic  
Digesters and  
Control Building

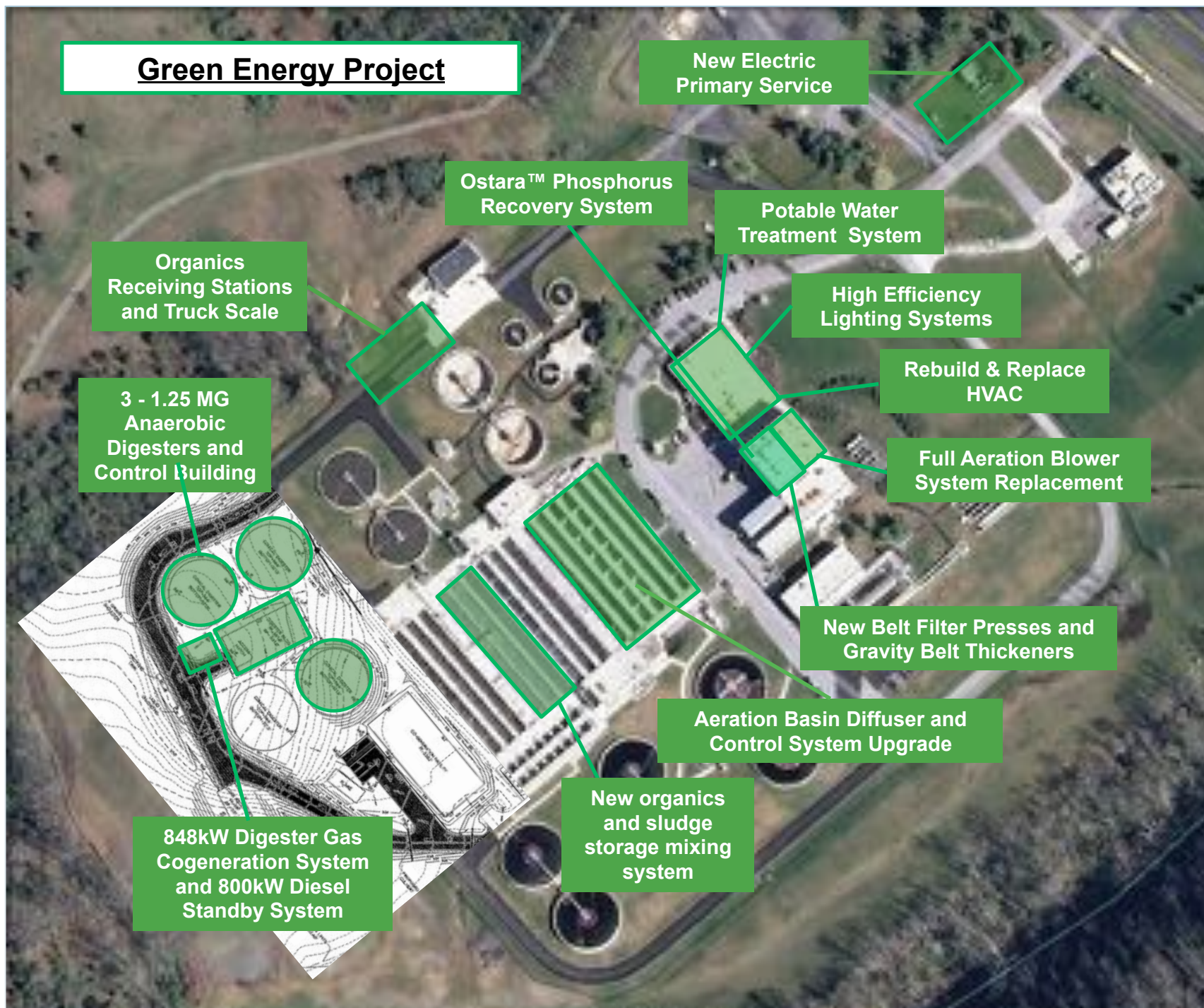
Full Aeration Blower  
System Replacement

New Belt Filter Presses and  
Gravity Belt Thickeners

Aeration Basin Diffuser and  
Control System Upgrade

New organics  
and sludge  
storage mixing  
system

848kW Digester Gas  
Cogeneration System  
and 800kW Diesel  
Standby System





# Administration Building Heating System

Old #2 Fuel Steam Boilers



New Propane Hot Water Boilers



# Aeration System

Old 450 hp  
multistage blowers



New 150 hp  
turbo blowers





# Aeration Basins

Old Diffusers



New Fine Bubble Diffusers



# Dewatering Systems

**Old Plate and Frame Presses  
with Lime Stabilization**



**New Belt Filter Presses  
and Gravity Belt Thickeners**



# Dewatered Sludge = Cake





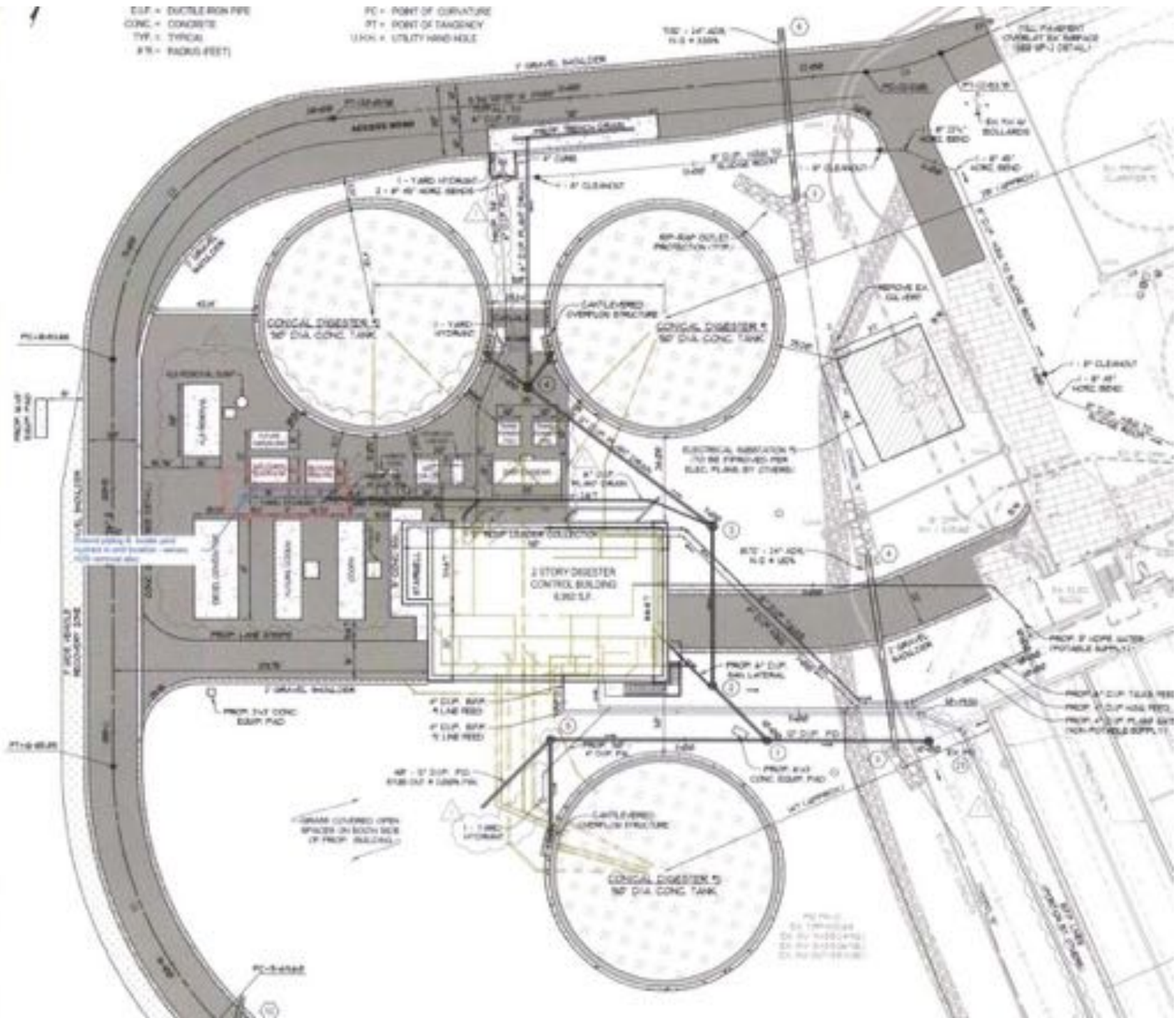
# New Substation

- New 12.47 kV Switchgear replaces existing switchgear.
- Site has two separate incoming feeds for redundancy.

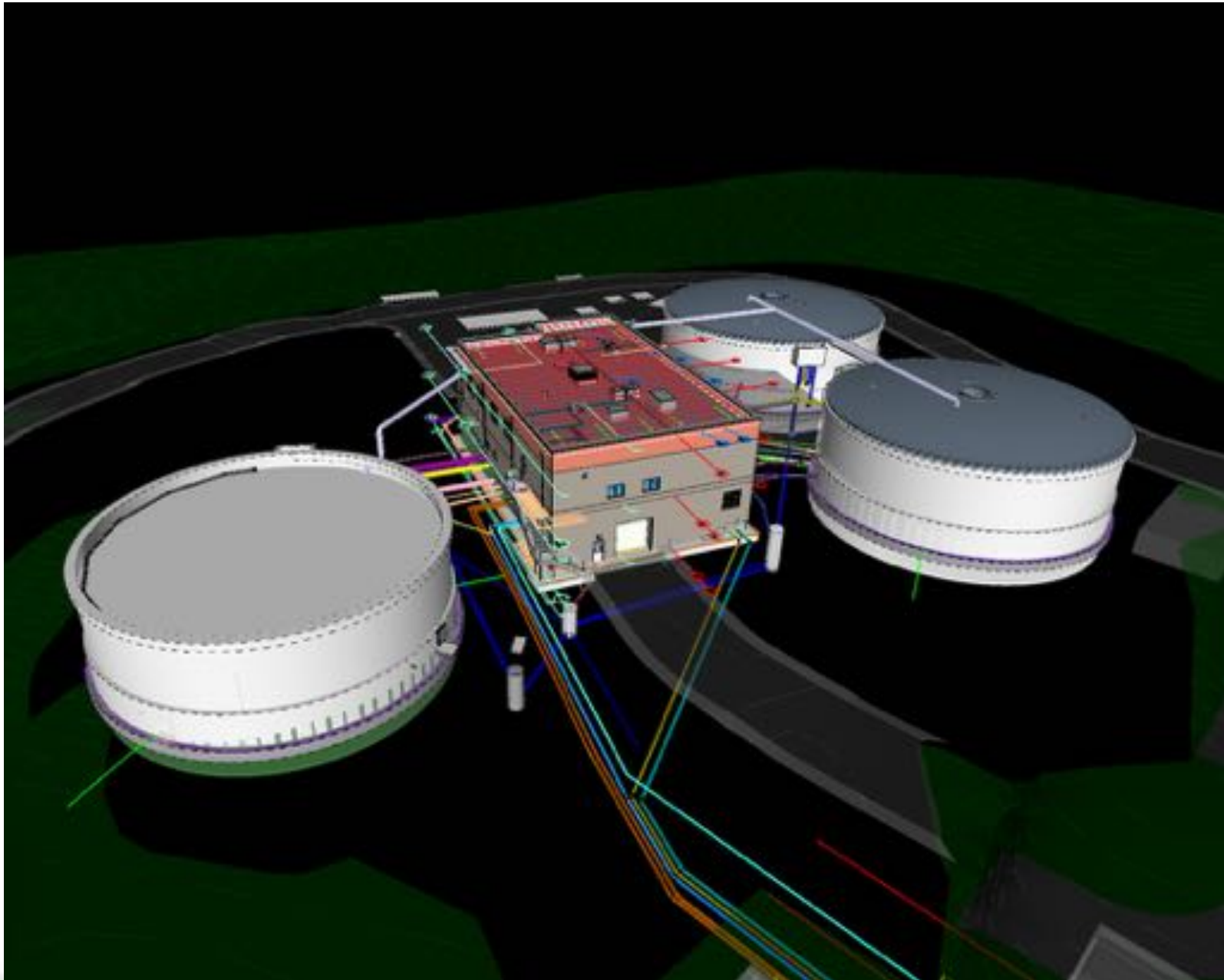




**ESG** ENVIRONMENTAL SYSTEMS GROUP







# Green Energy Facility



ESG ENERGY SYSTEMS GROUP

# 848 kW biogas generator and 800 kw diesel backup







# Two Organics Receiving Stations









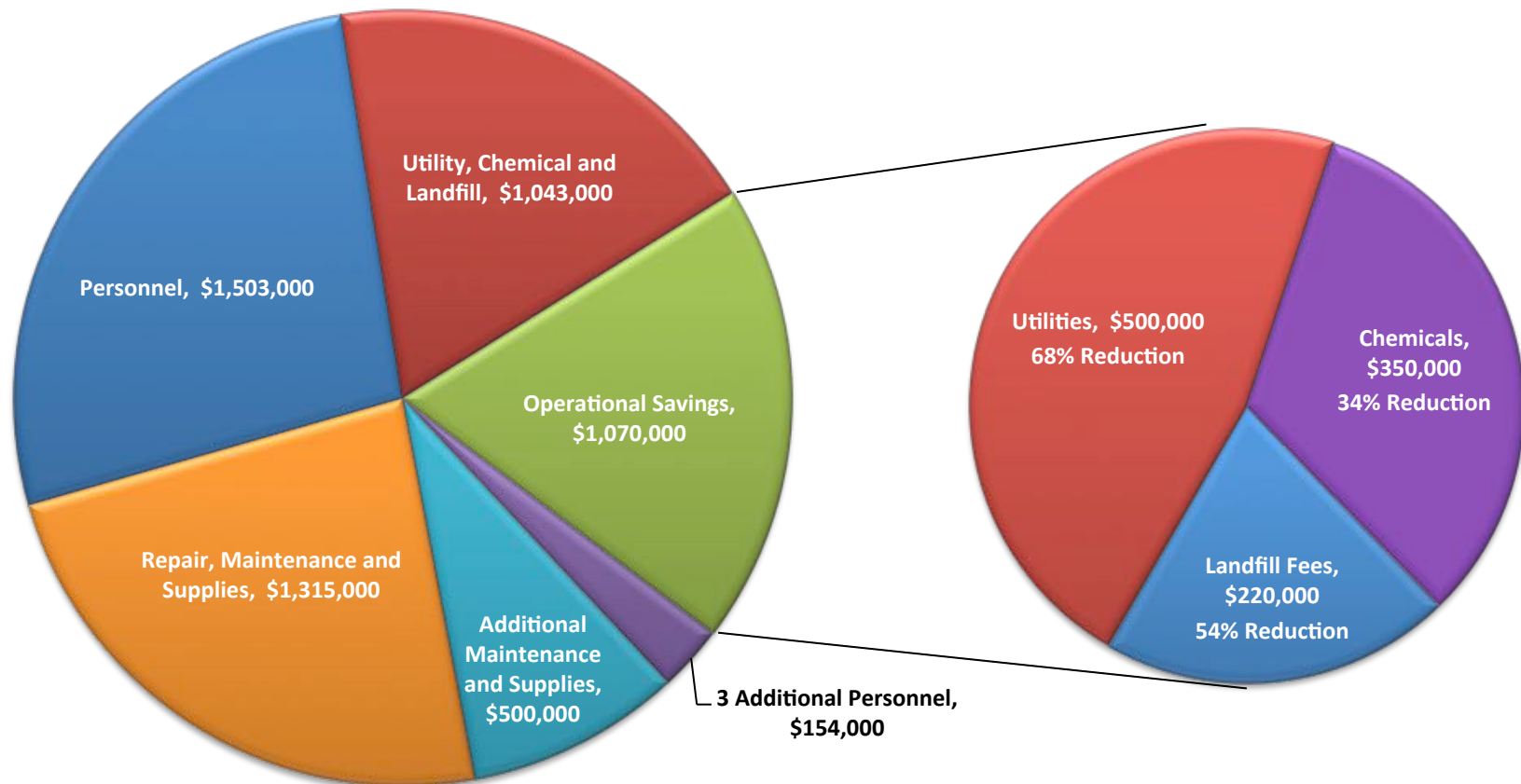
# Organic Waste Receiving



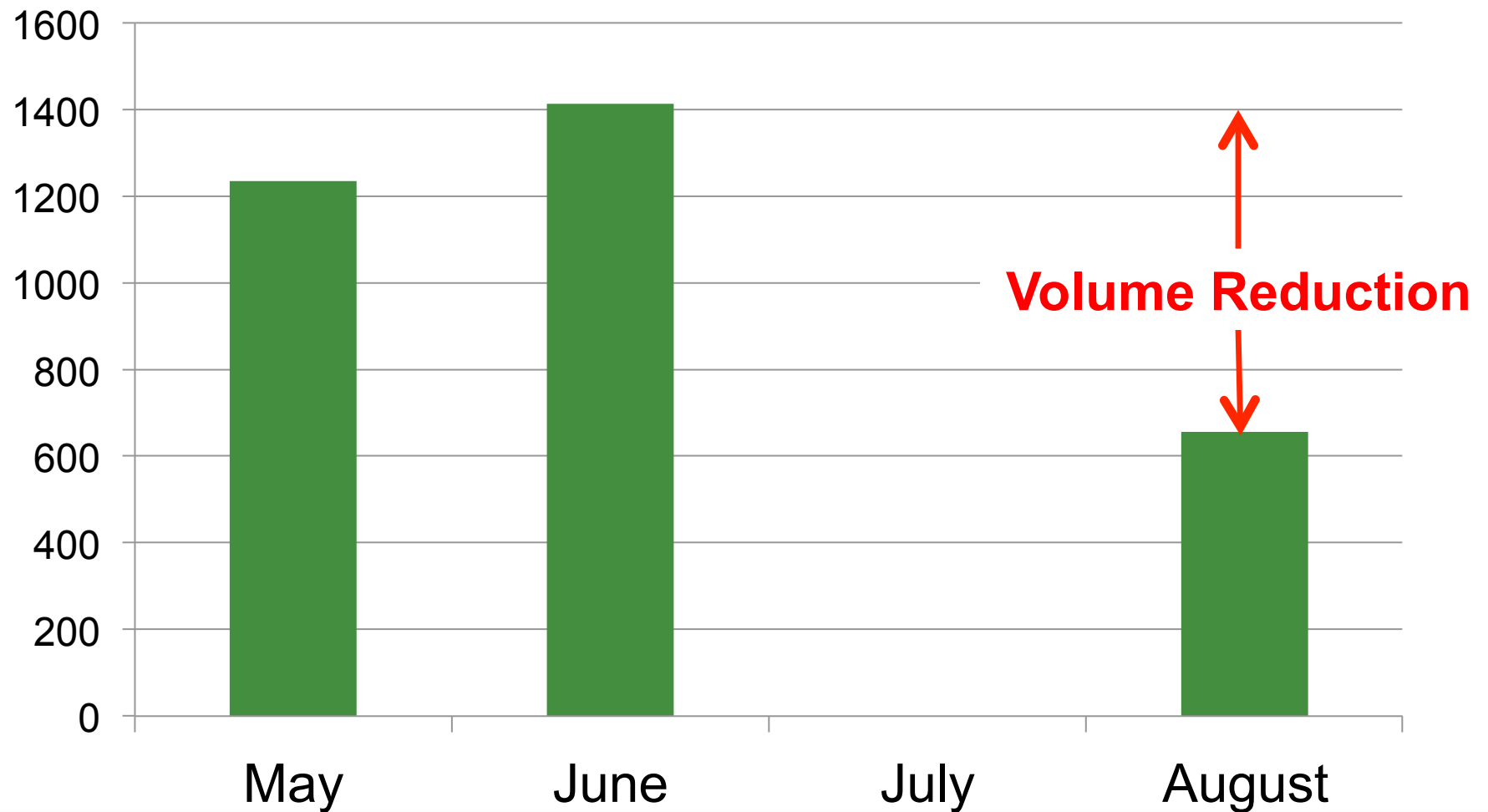




# Operational Budget Impact



# Cake tons to Landfill



# FWSA Revenue Projection

## Tipping Fee Revenue (First Year)

3 Community Industries (In Negotiation)	\$530,000
Septage and FOG	\$50,000
<u>Outside Community</u>	<u>\$50,000</u>
Total	\$630,000



# FWSA Revenue Now

<u>Under Contract</u>	<u>Now</u>	<u>Requested</u>
FOG Hauler #1	\$ 852,000	\$1,066,000
FOG Hauler #2	\$ 182,000	\$ 338,000
FOG Hauler #3	\$ 130,000	\$ 208,000
Municipal Sludge	\$ 14,000	\$ 14,000
Ethanol Waste	<u>\$ 8,000</u>	<u>\$ 10,000</u>
		\$1,185,000
\$1,636,000		

<u>Pending Contracts</u>	<u>Now</u>	<u>Requested</u>
Poultry DAF	\$ 130,000	\$ 156,000
Dairy DAF/Sludge	\$ 36,000	\$ 46,000
Beef DAF	\$ 52,000	\$ 73,000
Dairy Production	<u>\$ 200,000</u>	<u>\$ 230,000</u>
	\$ 418,000	\$ 505,000

**LIFE IS ALL  
RAINBOWS  
AND  
UNICORNS**

FONT CANDY

**RIGHT?**



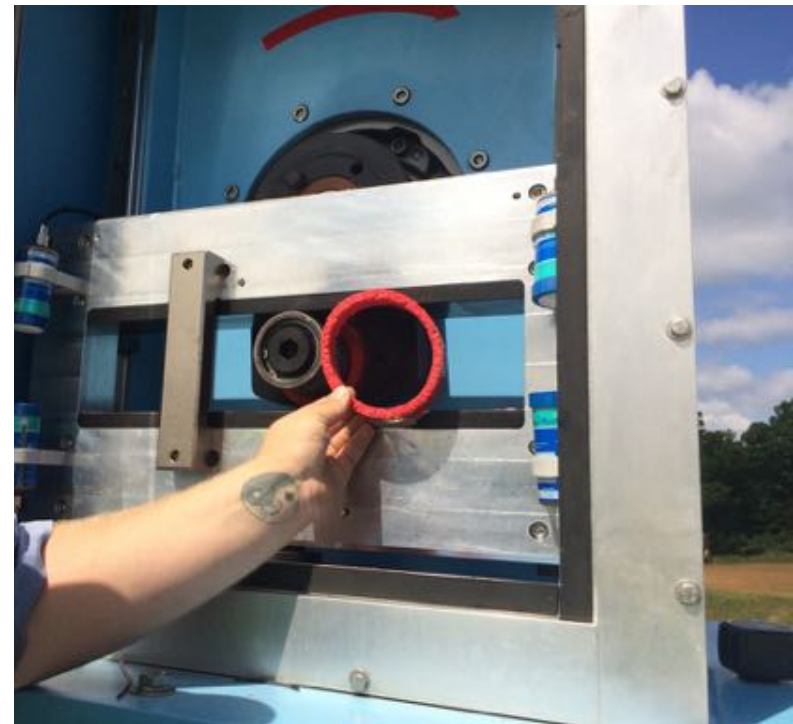
# Start Up Tuesday July 5, 2016

- Opened valves, started feeding digester #1
- Substantial leak on 6" sludge feed pipe flange
- Shut and drained piping, replaced gasket
- Restart feed later in day



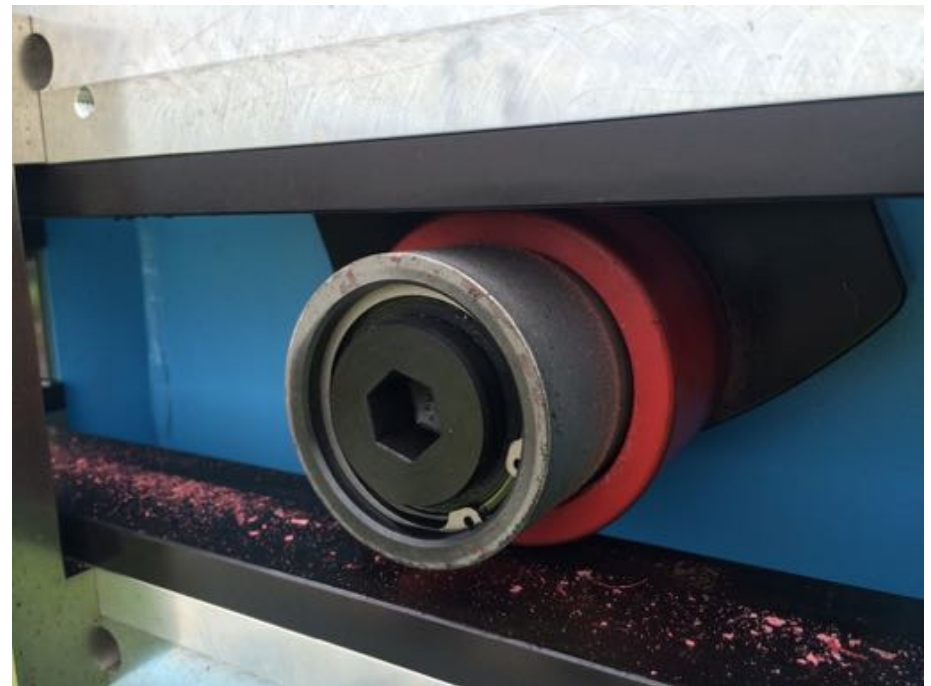
# Day One

- Linear Motion Mixer #1 “wheel” breaks
- Shut mixer off, replacement part will be delivered next day
- Easy fix predicted
- Started LM mixer on digester #2 (water only in digester)



## Day Two

- Maybe shut down digester #1 since mixer out of service?
- But after 24 hours, LM mixer failure digester #2, wheel problem
- Continue sludge feed digester #1, heat loop mixing only





## Day Two

- Seed arrives in afternoon
- Start seeding digester #1 via 6,500 gal tanker



## Day Three

- LM mixer #2 repaired, running smoothly
- New wheel fixes problem
- More seed deliveries scheduled



## Day Four

- Sludge recirculation grinder plugged with rags
- Suspect seed delivery included rags?
- Operators clean and reassemble





# Day Eight

- Grinder motor on, unit functioning?
- Cutting wheel not turning
- So rags accumulate!
- Replace drive gear with correct part
- Grinders running 24/7 since, no plugging





# Day Eight

- LM mixer repaired by technicians for primary digester #1
- Mixer on 24/7
- Also sludge recirculation operating 24/7
- Sludge overflow to secondary digester starts



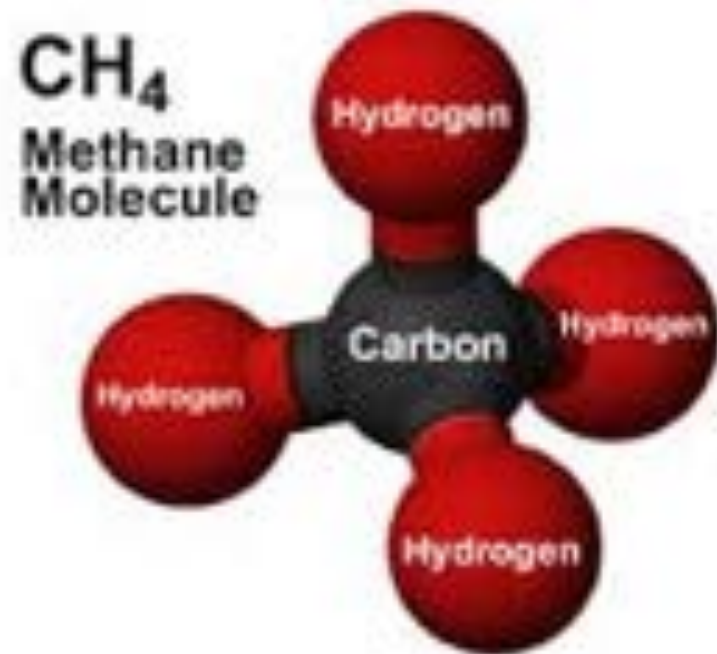
## Days 9, 10 & 11

- Seed delivery continues, total to date 100,000 gallons
- Digester chemistry:
  - pH 5.72
  - Alkalinity = 665 mg/l
  - VA = 798 mg/l
- Methane LEL = 29% in gas holder. Not sure what that means

**Bi-Carb  
Ordered!**

## Day 12

- Methane alarm goes off in secondary gas holder
- Sensor between inner and outer membranes
- Shut gas valve to secondary digester
- Manufacturer believes gas sensor malfunction
- Or maybe methanogens making biogas?





# Day 14

- Gas holder empty
- Appears inner membrane leak
- Secondary digester will be out of service as repairs are being done
- Suspect damage caused by foam busting system
- Support cables??



# Day 19

- Boiler for digester heating continues to shut down multiple times per day
- Flare started, sufficient methane from digester #1 to sustain flare





## Day 22

- Fully Empty Secondary Digester
- Remove membranes
- Clean Digester
- Repair & Reinstall



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## Day 28

- Start recuperative thickening, 75 GPM feed to GBT for 5 hours
- Experienced thickened sludge pump problems
- Adjust settings and continue running
- Multiple shut downs



## Day 29

- GBT operates great, but
- Thickened sludge motor HP too small, need to order larger pump and motor
- Expert Statement: all engineers select too small of a motor to push thickened sludge!!

**No Choice:  
start  
dewatering  
via belt  
press**

- Start Co-digestion by feeding FOG waste to digester
- Methane 65% in digester #1, 56% in digester #2
- Gas holder repairs complete, but unit not in operation
- Belt press operations smooth, 150 GPM feed, cake OK with existing polymer

## Days 30 - 32



## Day 35: Stability

- Continue feeding thickener sludge to digesters
- Continue feeding FOG to digesters (Co-digestion)
- FOG increases gas production
- Continue dewatering operations
- Digester Chemistry:
  - VA @ 231 mg/l
  - Alkalinity @ 1,875 mg/l
  - VA/Alk ratio = 0.12
  - pH @ 7.16
  - Methane 65%
- Digesters very stable



# Stability: Thanks to Opequon operators



# From Seed to Generation

- July 5<sup>th</sup>: Started feeding digester sludge
- July 22<sup>nd</sup>: Sufficient methane to start flare
- August 2<sup>nd</sup>: Co-digestion of FOG
- October 5<sup>th</sup>: Began generating electricity

# In Conclusion...



# Questions?

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# Project Overview (\$47M)

## Treatment Plant Infrastructure Upgrades

- **Aeration:** replace (4) 450hp multistage blowers with (4) 150hp turbo blowers, new electrical, fine bubble diffusers, piping, DO Probes and automated control valves. (Manual to Automated)
- **Dewatering:** Gravity belt thickeners, belt filter presses, chemical feed pumps, progressive cavity pumps and associated electrical. New Odor Control System.
- **Electrical:** new primary 12.5 kV switchgear unit, 800 kW emergency power system interconnected to cogeneration, net metering/grid paralleling capability
- **HVAC & Controls:** Boiler, MAU, CUH, S&EF & WSHP Replacements. DDC system Installation
- **Lighting Upgrades:** T-12 to T-8 upgrades and motion sensors
- **Potable Water Upgrades:** Storage Tank Replacement

## Green Energy and Resource Recovery

- **Anaerobic digestion:** (3) 1.25 million gallon digesters, 13,000 sf control building housing switchgear, lab, boilers, heat exchangers, grinders, pumps, compressors
- **CHP System & Backup Generator:** 848 kW electric cogeneration with biogas conditioning system; Baseload plant with export capability. 800 kW MTU Emergency Standby
- **(2) Receiving Stations:** High strength food waste and FOG receiving facilities with segregated waste storage. Truck scale and billing system.
- **Phosphorus Nutrient Recovery:** Ostara Pearl® system