

EPA Sustainable Materials Management  
Web Academy  
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# WASTED FOOD TO ENERGY

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Sheboygan Regional WWTF  
Sheboygan, Wisconsin



# Sheboygan Regional WWTF



- 7 Communities, Western Shore of Lake Michigan
- Population 68,000
- 18.4 MGD Average, 56.8 MGD Max
- 10 MGD Average Daily Flow
- Activated Sludge with Biological P Removal and backup Ferric Chloride Addition
- Anaerobic Co-Digestion, Biogas Recovery, and Combined Heat & Power
- Liquid Storage of AD Biosolids and Biosolids Drying & Storage
- \$4.7 Million O&M Budget
- 2013 ACEC Engineering Excellence Grand Award - Net Zero Energy



# Biogas to Energy



**2005**

Energy conservation initiatives  
& Co-digestion implemented

**2006**

Co-digestion  
program increased  
biogas

**2012**

Purchased biogas  
conditioning equipment and  
turbines from Alliant Energy  
- City recoups all cost  
savings from biogas to  
energy systems

**2006**

Partnered with Alliant  
Energy - installed biogas  
conditioning and turbines;  
300 kW, 1MMBtu/hour  
heat

**2010**

Installed additional biogas  
conditioning and turbines;  
400 kW,  
1.4MMBtu/hour heat

# Initial CHP Generation Project



*Alliant Energy-Wisconsin Power & Light funded the turbine project and recovered costs through the sale of generated electricity to the WWTF*

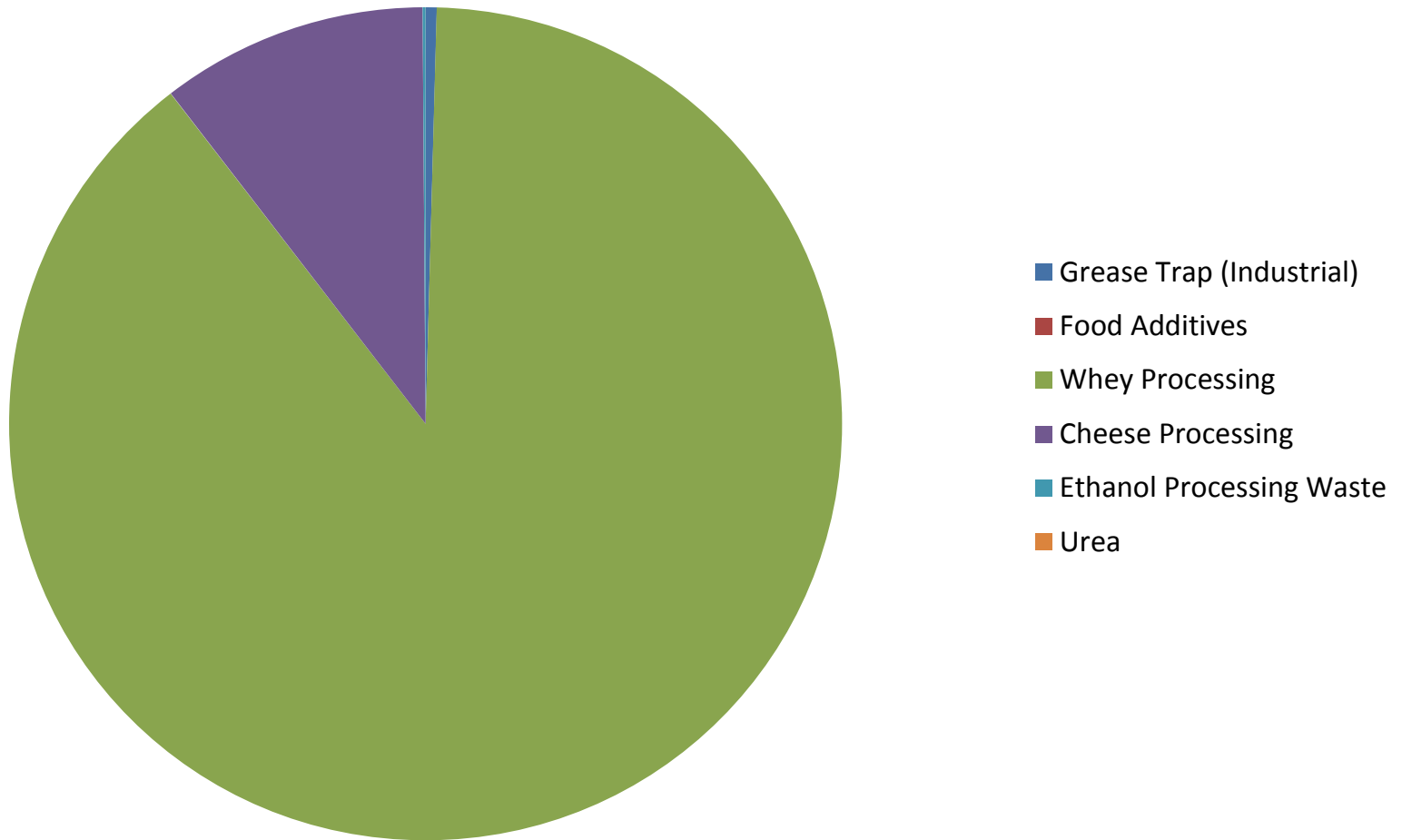
- 10—30 kW Capstone Turbines
- 2 Cain Heat Exchangers
- Unison Gas Conditioning
- 300 kW Electrical Power
- 1 MMBtu per hour heat recovery
- Electricity and heat produced is used onsite to power equipment and heat the digesters and plant buildings in the winter

# Co-Digestion Program Implemented



- Repurposed existing unused digesters
- Predominately dairy waste
- Tanker trucks 24/7 access
- 6000 gal/load

# Types of HSW



# HSW Receiving & Feeding Components

HSW Unloading



In-line Strainer



HSW Feed Pump



# Second CHP Generation Project



- 2—200 kW Capstone Turbines
- 2 Cain Heat Exchangers
- Unison Gas Conditioning
- 400 kW Electrical Power
- 1.4 MMBtu per hour heat recovery
- Allowed beneficial use of excess biogas



# Biosolids Storage Requirements

- NR 204 Requires 180 day biosolids (winter) storage
- Increase in biosolids production attributable to HSW program
- 10.08 MG required; 5.96 MG available
- Alternatives considered to expand biosolids storage capacity
  - Minimal additional liquid storage & eliminate HSW receiving program
  - Large scale liquid storage
  - Liquid storage & drying

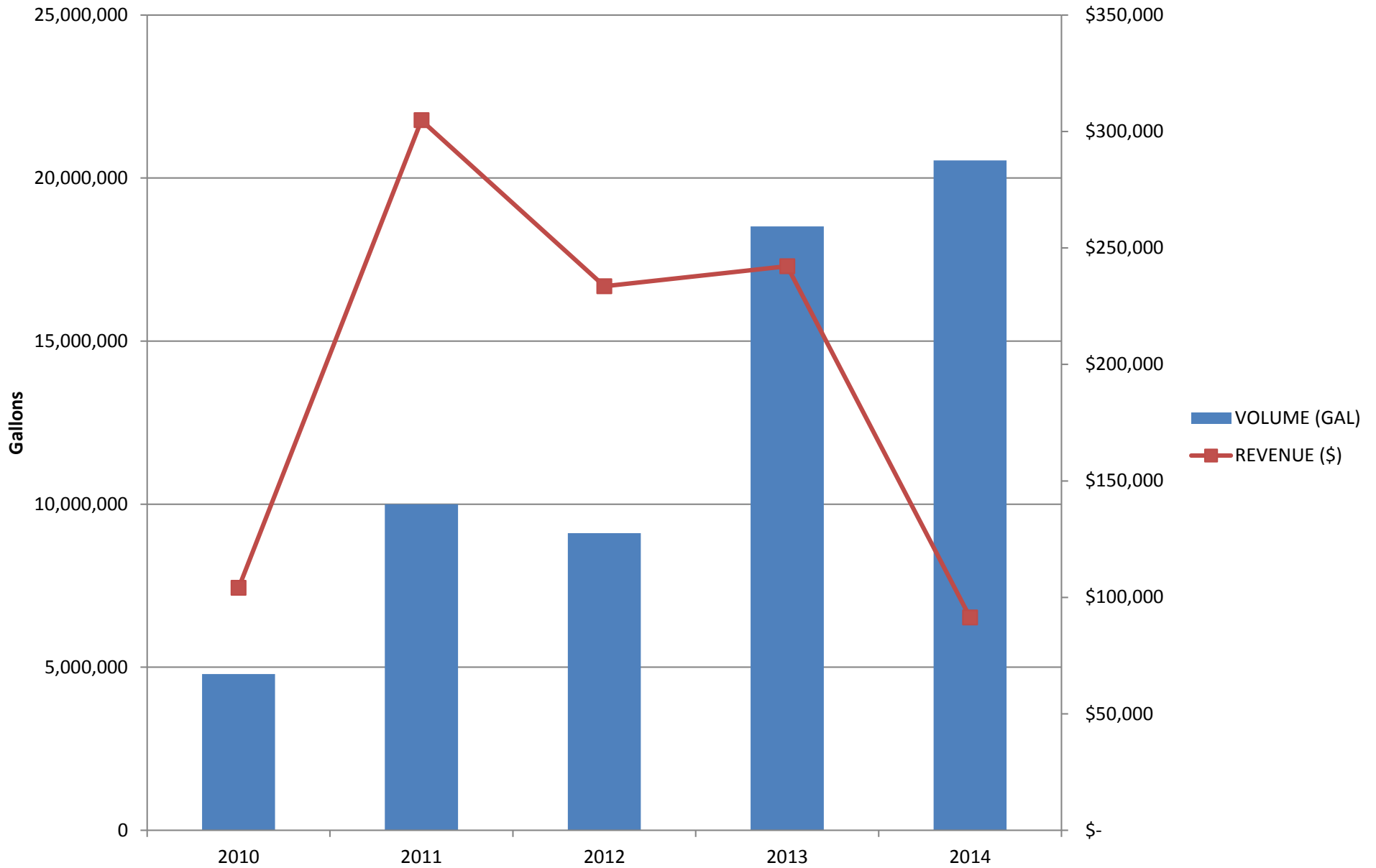
# Biosolids Process Improvements



# 10 Years of HSW Program

- Process 60,000 gpd High Strength Waste
- Biogas Produced: 500,000 ft<sup>3</sup>/day
- Biogas Quality: 65% Methane
- Equipment Installed: 700kW Electrical Generation
- Electrical Energy Produced: 5,010,000 kWh annually (2013)
- Thermal Energy Produced: 42,000 therms annually (2013)
- Energy Savings: \$270,000 annually (2013)  
*\$0.05/kwh=\$250,000; \$0.51/therm=\$21,000*
- CHP Program Produces: 90% Electrical Needs & 85% Heating Requirements

# Volume HSW & Revenue



# HSW Challenges



# CAPITAL INVESTMENTS

Project	Project Cost	Funding Assistance	City's Cost
Co-digestion	\$75,000	\$0	\$75,000
CHP Phase I	\$1,200,000	\$899,000 Alliant Energy	\$301,000
CHP Phase II	\$1,500,000	\$205,000 Grant	\$1,295,000
<b>Total</b>	<b>\$2,775,000</b>	<b>\$1,104,000</b>	<b>\$1,671,000</b>

# Competition for HSW

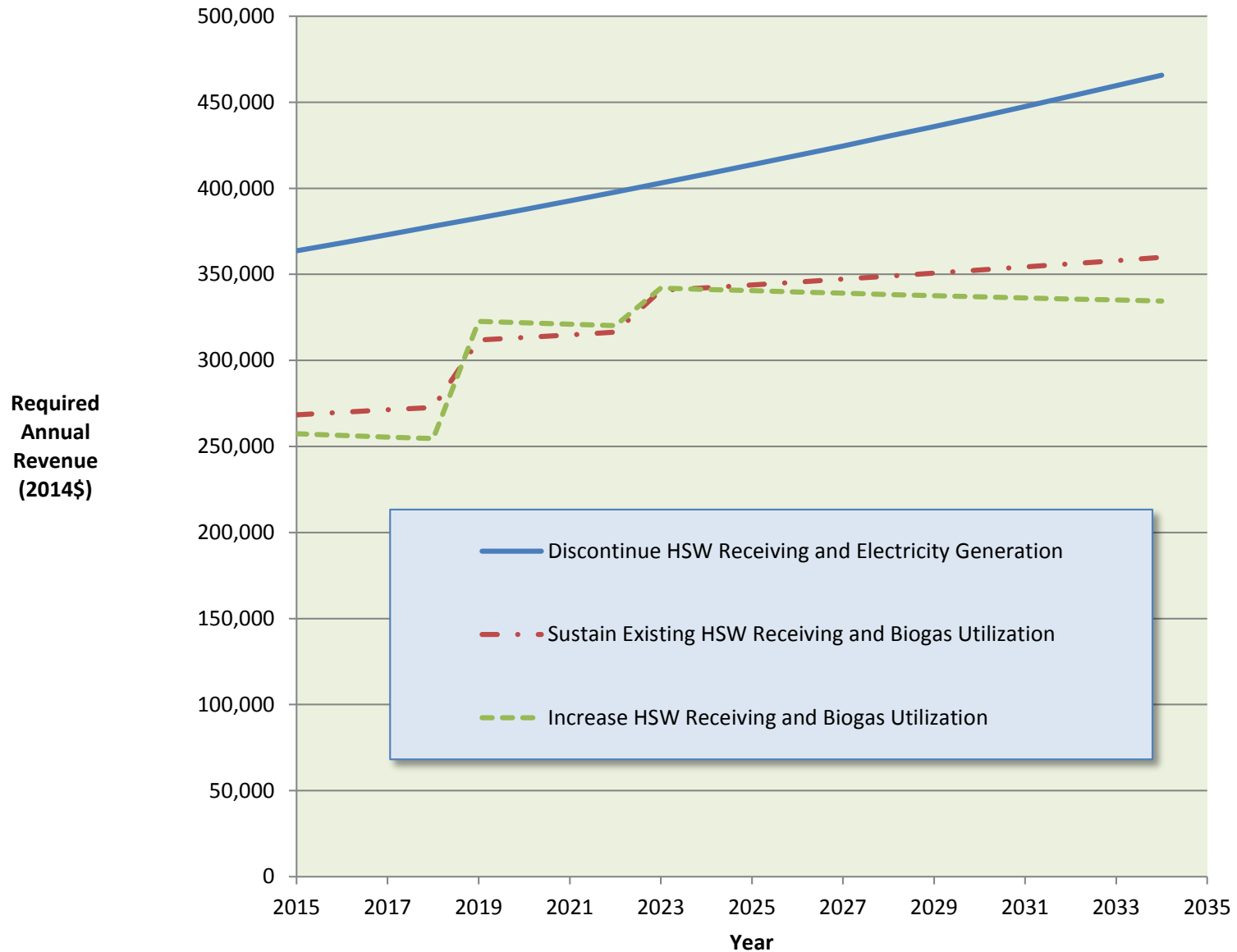
2005

- Sheboygan only regional HSW program
- Increasing revenue from tipping fees
- Significant grant money available
- Utilized existing tank capacity

2014 – BOD Wars

- Multiple POTW co-digestion programs
- Multiple agriculture co-digestion programs
- Private co-digestion programs
- 90% HSW from one supplier
- <\$100,000 Tipping Fees
- Minimal grant money available
- Significant capital improvements to continue HSW and co-digestion
- Offset in energy costs sufficient to fund capital improvements

# Future of Co-Digestion Program





# Moving Forward

## Reducing Energy Consumption



- Team Effort
- Evaluate Payback Costs for New Projects
- Partner With the Local Utility
- Keep User Rates Low
- Continue Path to Sustainability & Being a RESOURCE RECOVERY FACILITY

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