

Gloversville-Johnstown Innovative Solutions:

Brown to Green

October 6, 2010



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Background...

- ◆ Gloversville-Johnstown WWTF opened in 1972, anaerobic digesters added in 1990
- ◆ Small plant, but large volume of sludge
- ◆ Sludge disposal big factor
- ◆ Located near Albany, NY



GJJWTF 20 Years ADG/CHP experience:

- ◆ 1990 – 2005: poorly operated an anaerobic digester and CHP system
- ◆ 2005 – 2010: improved ADG and CHP system and took advantage of benefits
- ◆ 2010 - Future: \$10.6 million upgrade becomes operational

Digester 1990 Concept...

- ◆ Stabilize sludge per regulations
- ◆ Reduce sludge quantities hauled to the landfill by 33%, save tipping fees
- ◆ Operate one 150 KW biogas generator for some electricity
- ◆ Natural gas and electricity was cheap, so if biogas went to the flare, who cares?
- ◆ Combined Heat & Power??? Not in vocabulary.

Something Changed...

- ◆ Local Leather manufacturing base crumbled in the mid 1990's, wastewater revenue lost
- ◆ Operating money sparse
- ◆ Electricity prices soared by mid 2005
- ◆ Why not market underutilized digester and use CHP system to save \$\$ and generate revenue?

Marketing Results...

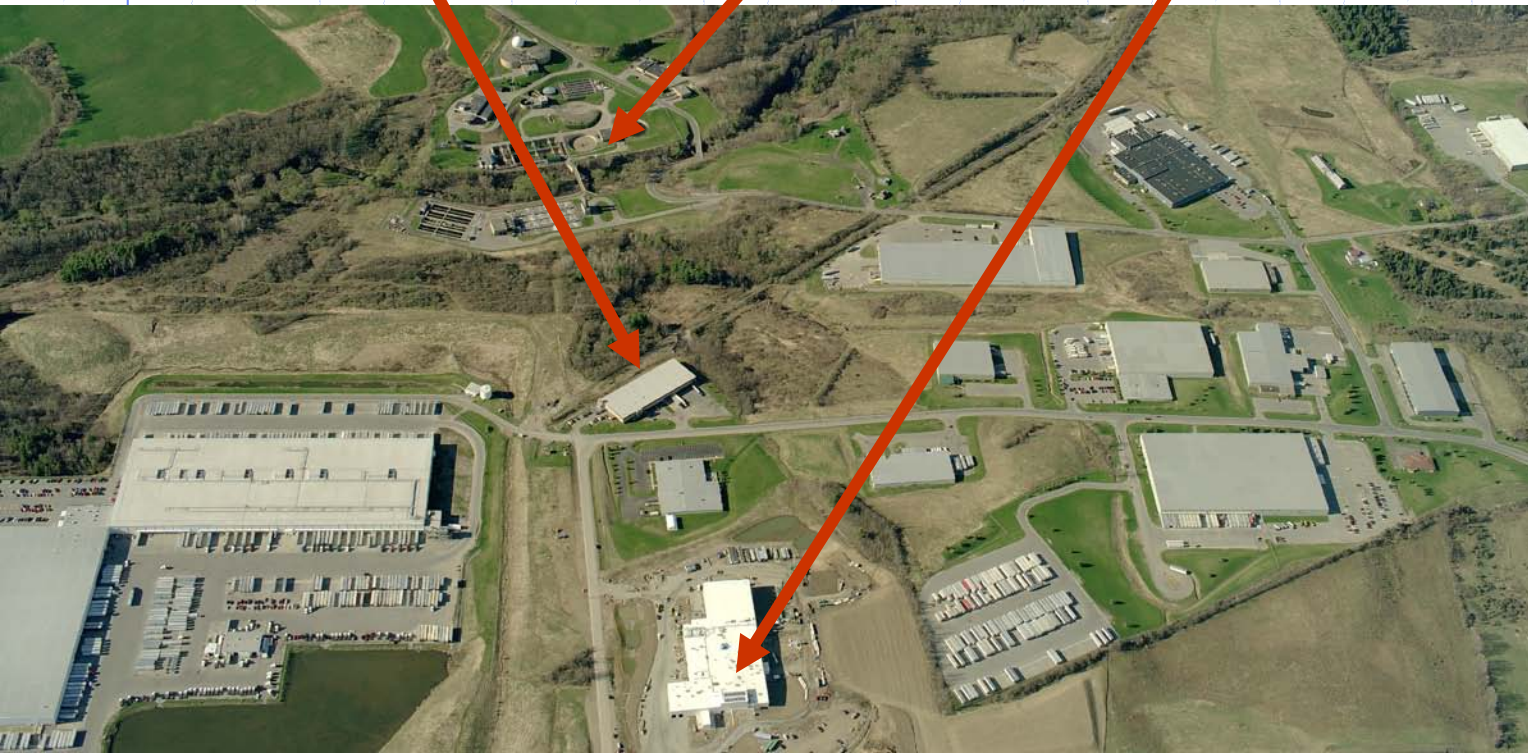


Cheese Plant

Wastewater Plant

Yogurt Plant

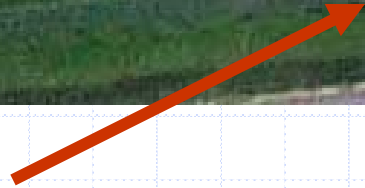
Via Truck



Digester project 2005...

- ◆ Eliminate biogas leakage
- ◆ Create biogas storage
- ◆ Run both 150 kW engines 24/7 to optimize on site electrical generation
- ◆ Reduce natural gas purchase

1,500,000 Gallon Digesters...



Gas Flare

Gas Holder

Secondary Digester: Repair Cover

Gas Holder...

- ◆ Constructed gas holder
- ◆ 50,000 cubic feet capacity
- ◆ Inner "lung" expands and contracts



90,000 gallon whey tank

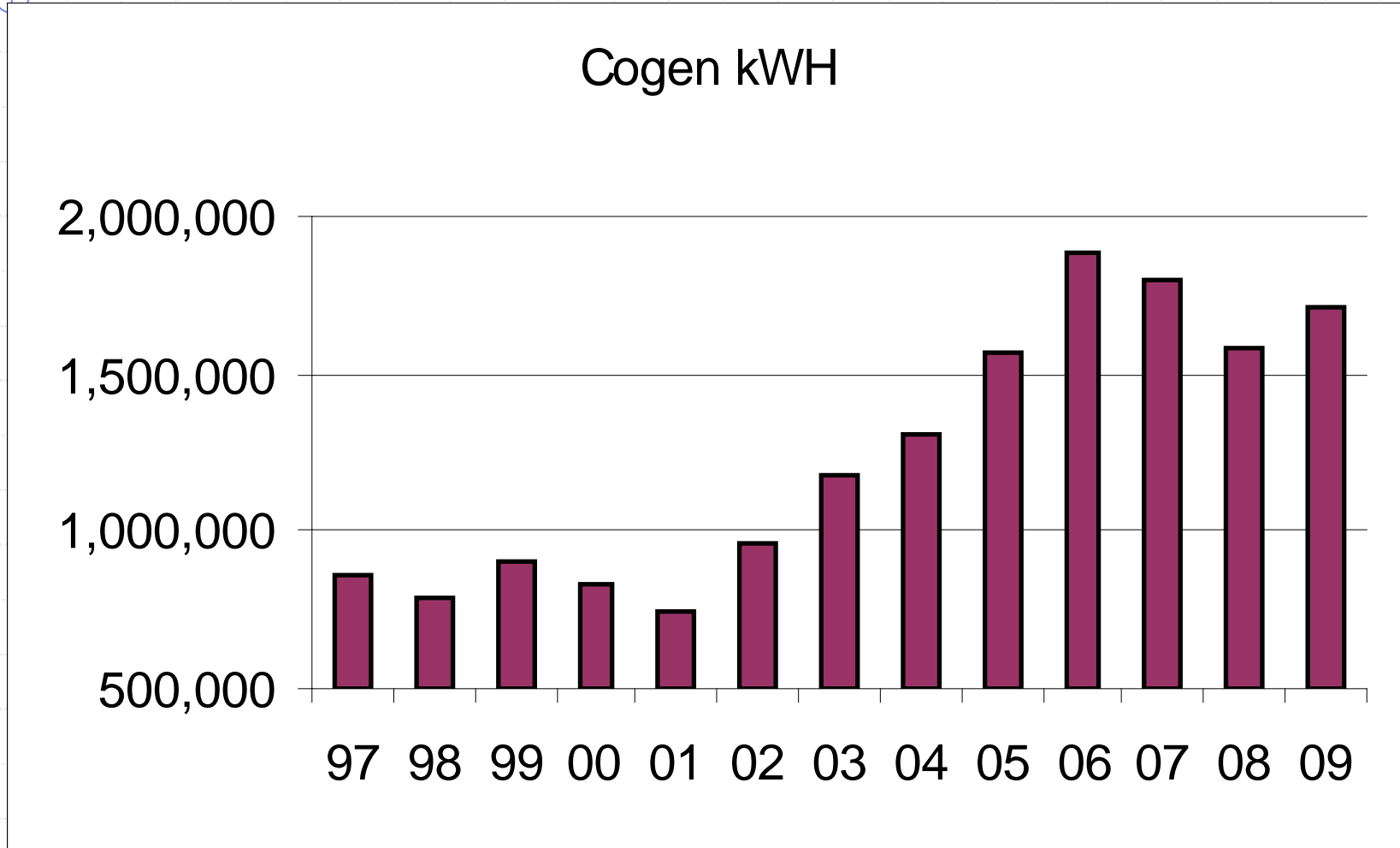
- ◆ Controlled feed of high strength liquid waste to digester (dairy industry)



2005 Digester project results:

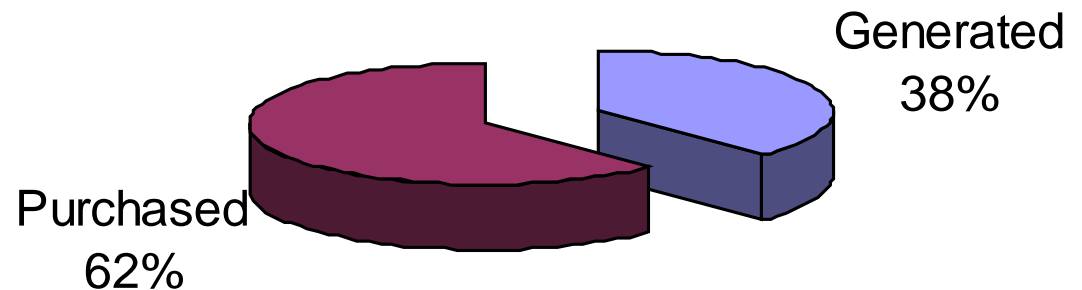
- ◆ Capture and generate more biogas
- ◆ Purchase less electricity and natural gas
- ◆ Generate more electricity
- ◆ Dairy industries started using more of the digester capacity...

2005 Project: about 40% green



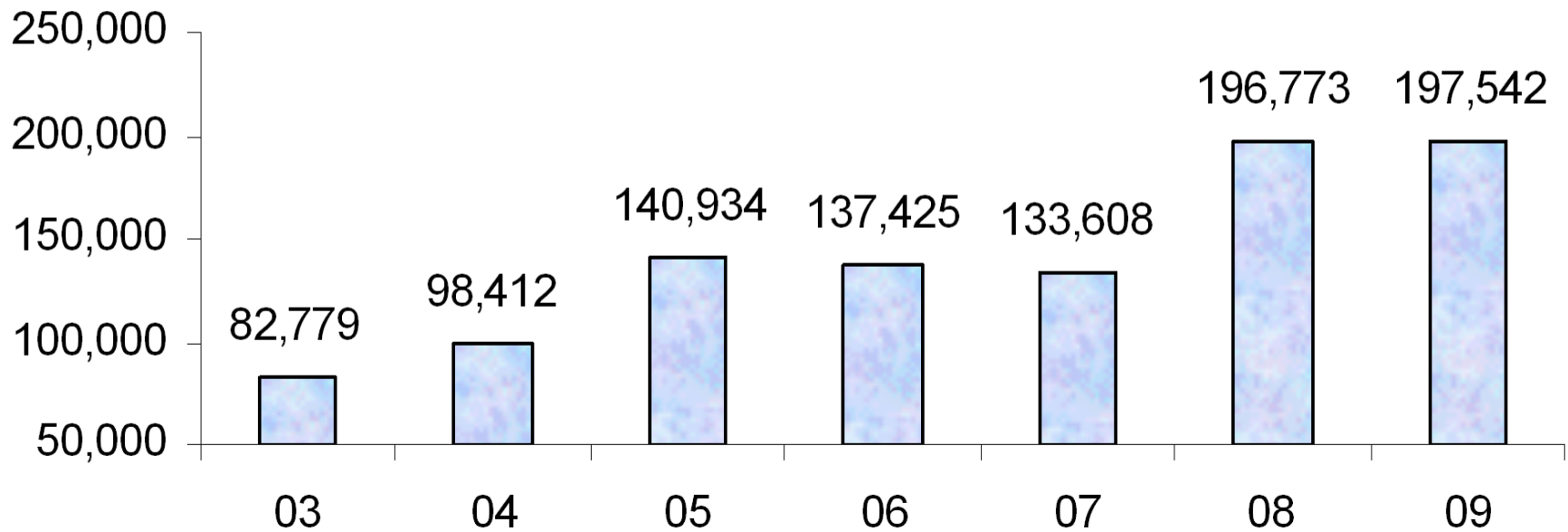
Cogeneration 2009:

- ◆ System now produces 1.8 million kWh of electricity annually, value \$273,000
- ◆ In 2009 purchased ~\$400,000 of electricity from the grid

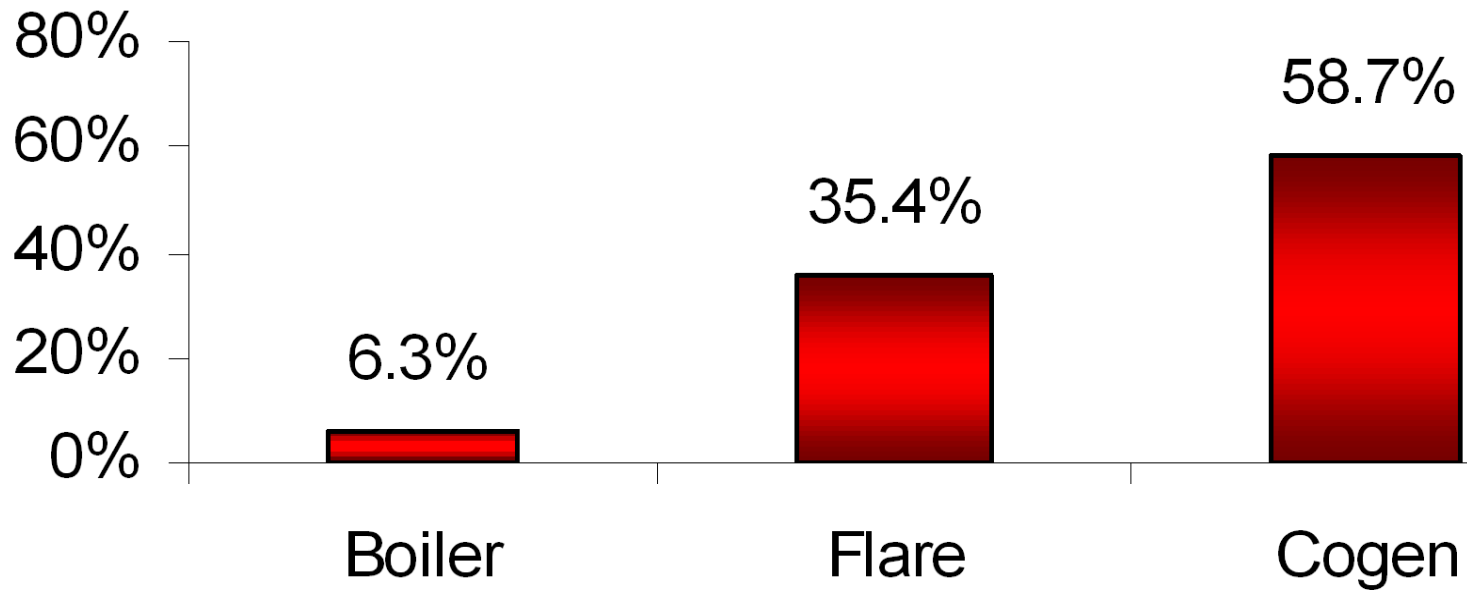


Capturing 100% more biogas

Biogas CFD



Biogas Utilization 2009



CHP: Heat Important!!

- ◆ Anaerobic digesters need to operate at a certain range (98 degrees F)
- ◆ Tremendous btu requirement to raise 120,000 GPD sludge from 60 to 98 degrees
- ◆ Heat recovery often overlooked, yet digester heating required 365 days per year
- ◆ To heat a digester, need 17,000 decatherms annually, value at \$200,000
- ◆ "Free" heat from engines or "Free" heat from combusting biogas in boiler
- ◆ GJJWTF: virtually no natural gas purchase

Excess biogas: to flare

- ◆ If engines and boilers at 100%, no choice but to waste
- ◆ Shameful sending biogas to the flare
- ◆ Develop new project to utilize waste gas??



2009 – 2010 Project...

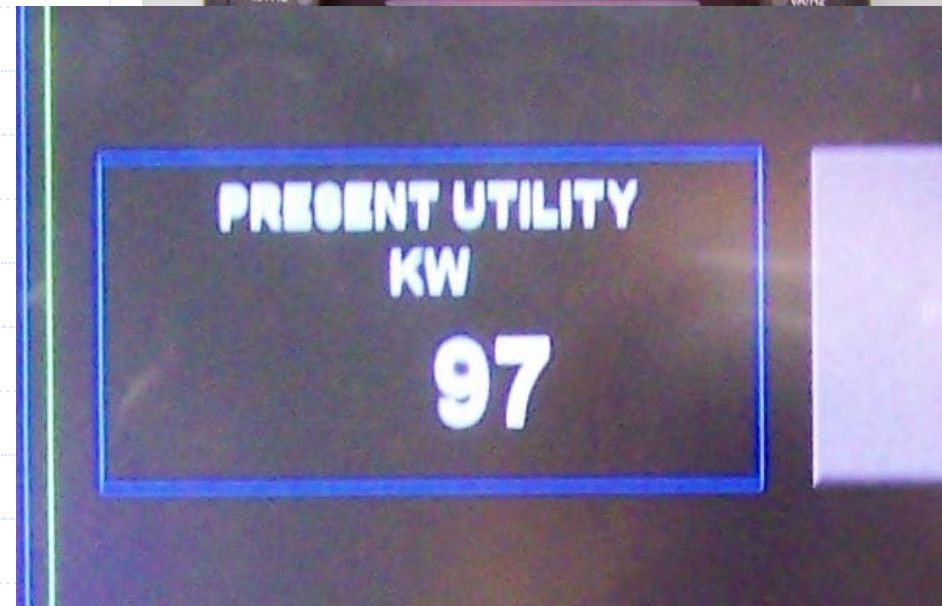
- ◆ Comprehensive \$10.6 million upgrade (about 95% complete)
- ◆ Biogas generators, sludge dewatering, Dissolved Air Floatation, etc.
- ◆ Two 350 kW generators operational
- ◆ Cost generator portion ~ \$3 million

Was 300 kW, now 700 kW!!!

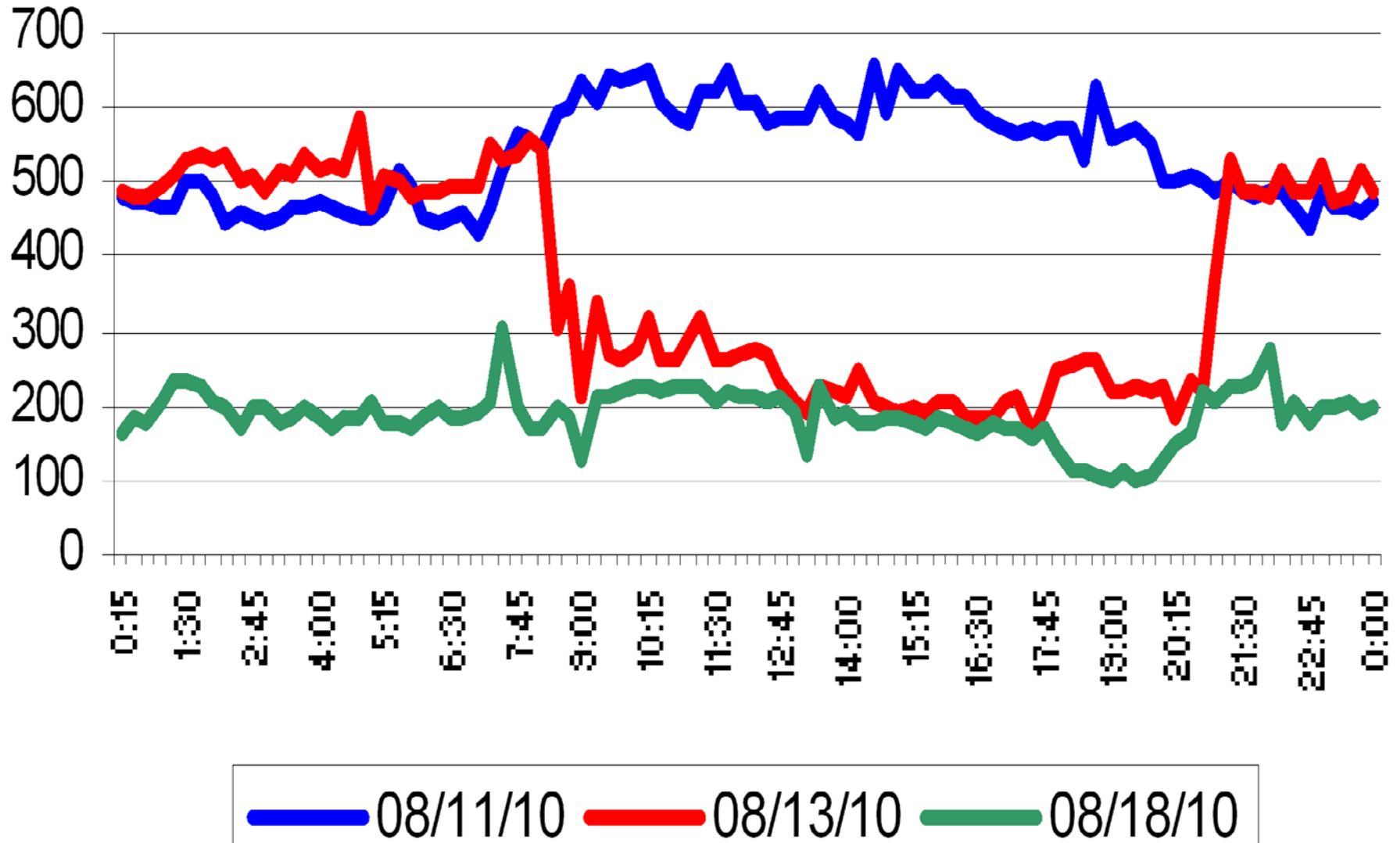


New Generators Operational:

- ◆ Upgrade generators can produce 700 KW with biogas fuel
- ◆ Parallel with Utility, but no export (for now)
- ◆ Biogas quantity sufficient to run generators 24/7
- ◆ Example: 83% generated, 17% from grid
- ◆ Utility meter at 0 kW?



Purchased KW



Gravity Belt Thickening

- ◆ Thicken sludge prior to pumping to digester
- ◆ GBT unit thickens to 7% solids
- ◆ Reduces water to digester thus reducing heating requirement and provides longer detention time

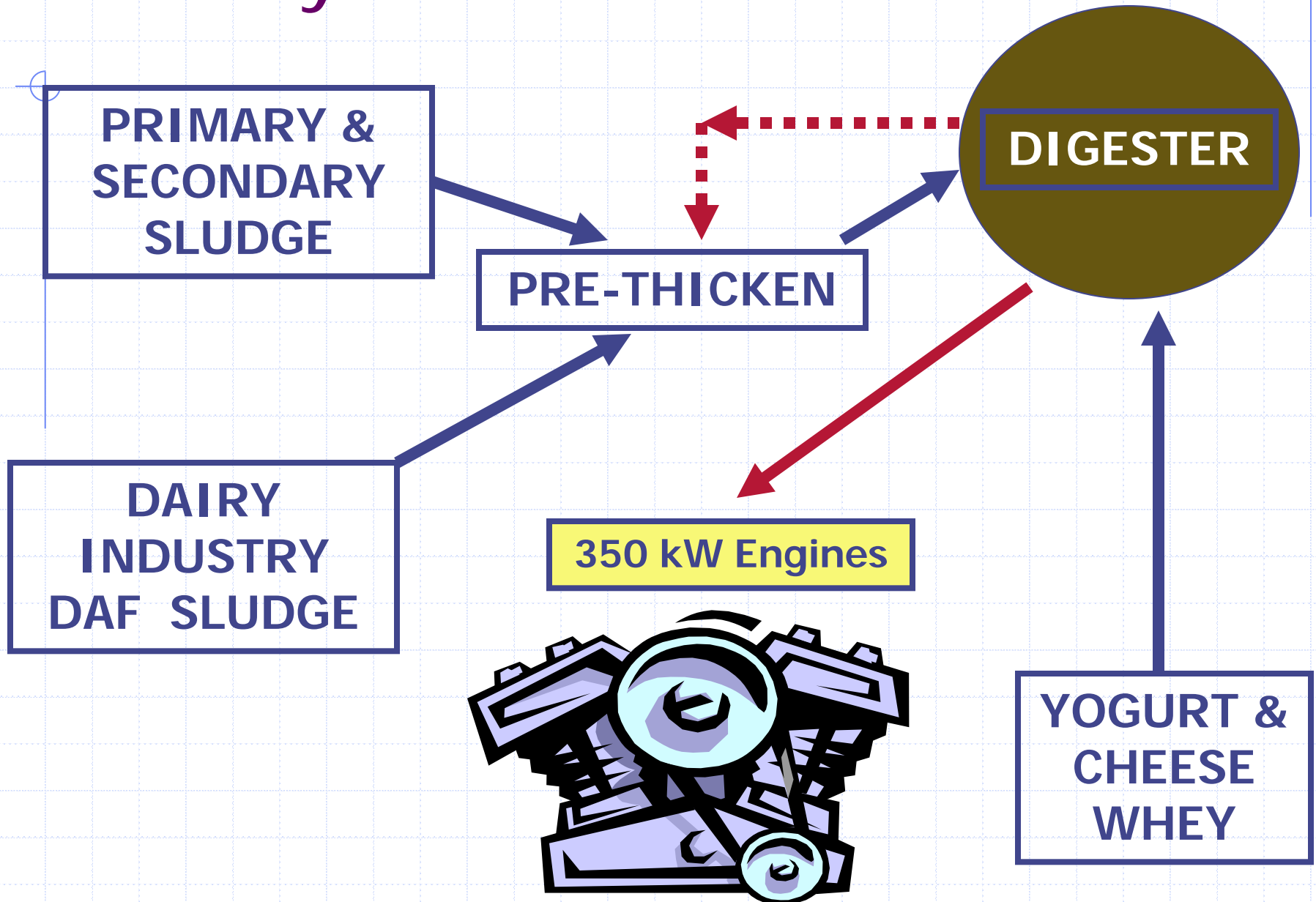


Additional 200,000 Whey Tank

- ◆ Controlled feed of high strength waste to digester



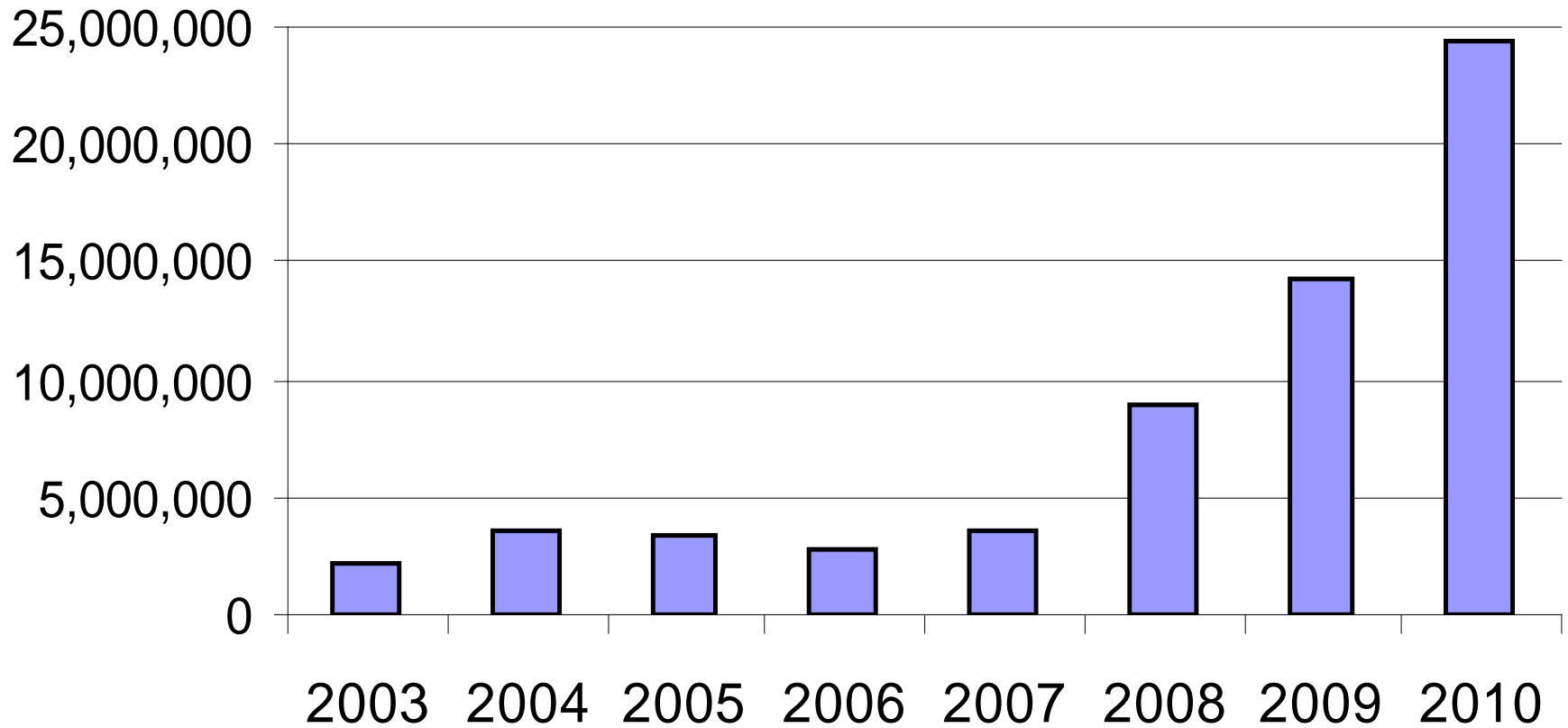
New System...



High Strength Waste:

- ◆ Digester = low energy requirement to treat high strength waste
- ◆ Dairy whey >50,000 mg/l BOD
- ◆ Digester reduction of BOD ~90%
- ◆ On average, 40,000 gallons sludge, 80,000 gallons whey treated each day
- ◆ High strength waste = high biogas generation

Whey Gallons Digested

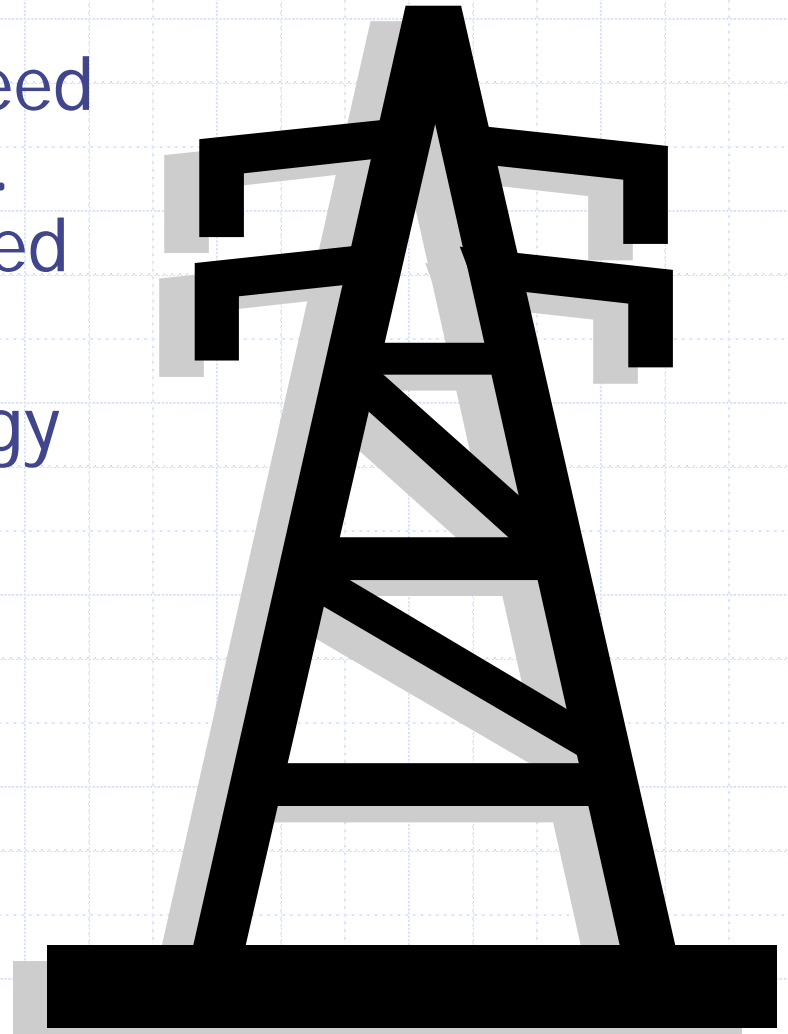


Fully Operational Soon??

- ◆ Facility needs 4.5 million kW annually to operate
- ◆ New generators: if they operate at 90% capacity year round, 5.5 million kW generated
- ◆ Units will work parallel with electric grid
- ◆ Future: if excess, sell back to grid

Energy Bill:

- ◆ Wastewater = hospital, need uninterrupted 24/7 power. If both generators fail, need power from grid
- ◆ Was SC 3, now SC 7 energy customer
- ◆ SC 7 requires payment of standby fees (\$68 K less credit annually)
- ◆ Approach 100% power generated on-site and eliminate energy bill



Project Financing:

| | |
|--------------------------------|-----------------|
| ◆ NYSERDA (ADG to electricity) | \$1.0 M |
| ◆ NYSERDA (demonstration) | \$0.4 M |
| ◆ EDA (job growth) | \$2.2 M |
| ◆ EFC (GIGP, Stimulus) | \$6.0 M |
| ◆ Local funding | <u>\$1.0 M</u> |
| ◆ Total Project cost | \$10.6 M |

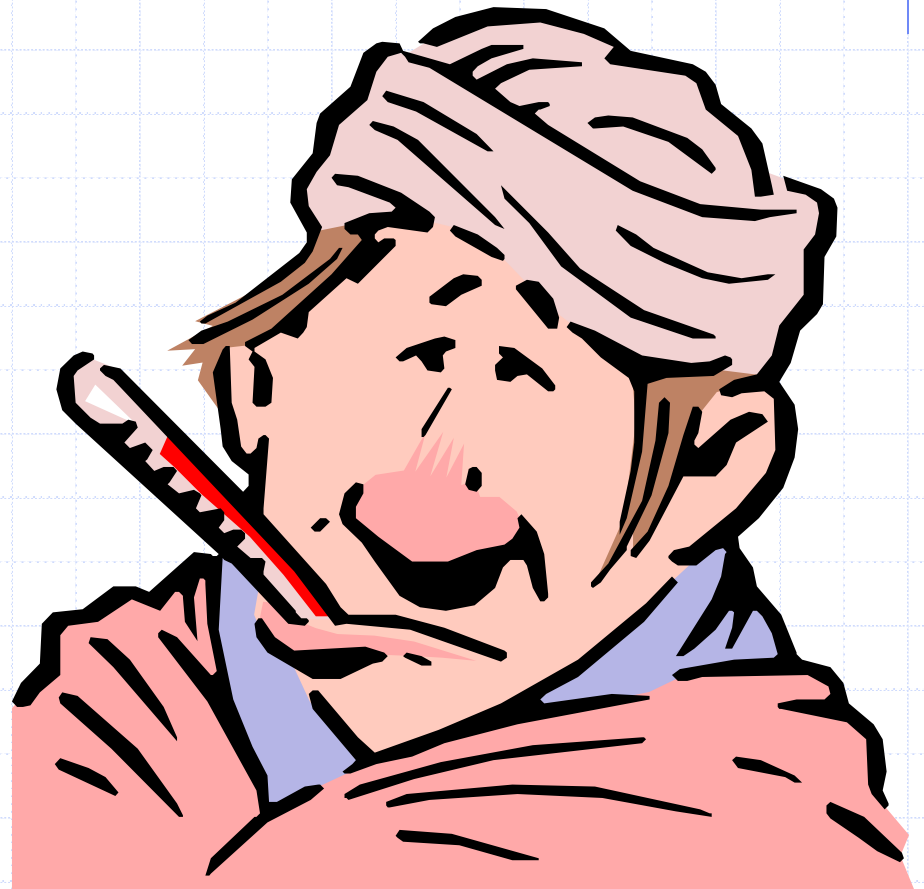
KEY: Green Grant & EFC!!!

Innovation = Success Always

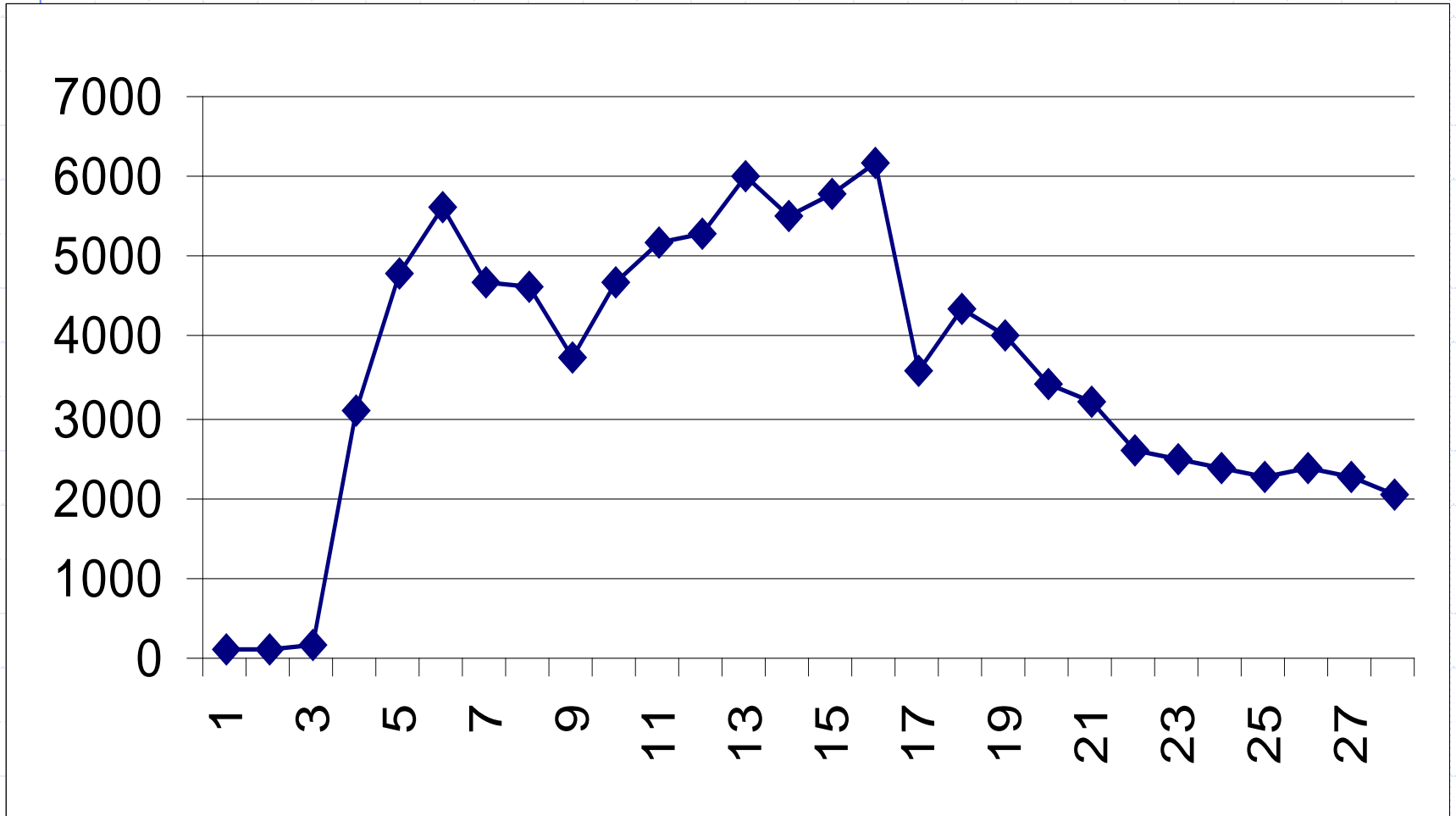
- ◆ Project seems innovative...
- ◆ A small two city wastewater facility is treating a very large quantity of high strength wastewater from local industry
- ◆ Co-Digestion of sludge and whey, Cogeneration of heat and power
- ◆ What could possibly go wrong with this master plan?

Overeat = Stomach Ache

- ◆ An anaerobic digester depends on living organisms
- ◆ Too much food results in too much acid
- ◆ System can be upset overnight
- ◆ Rolaid's????



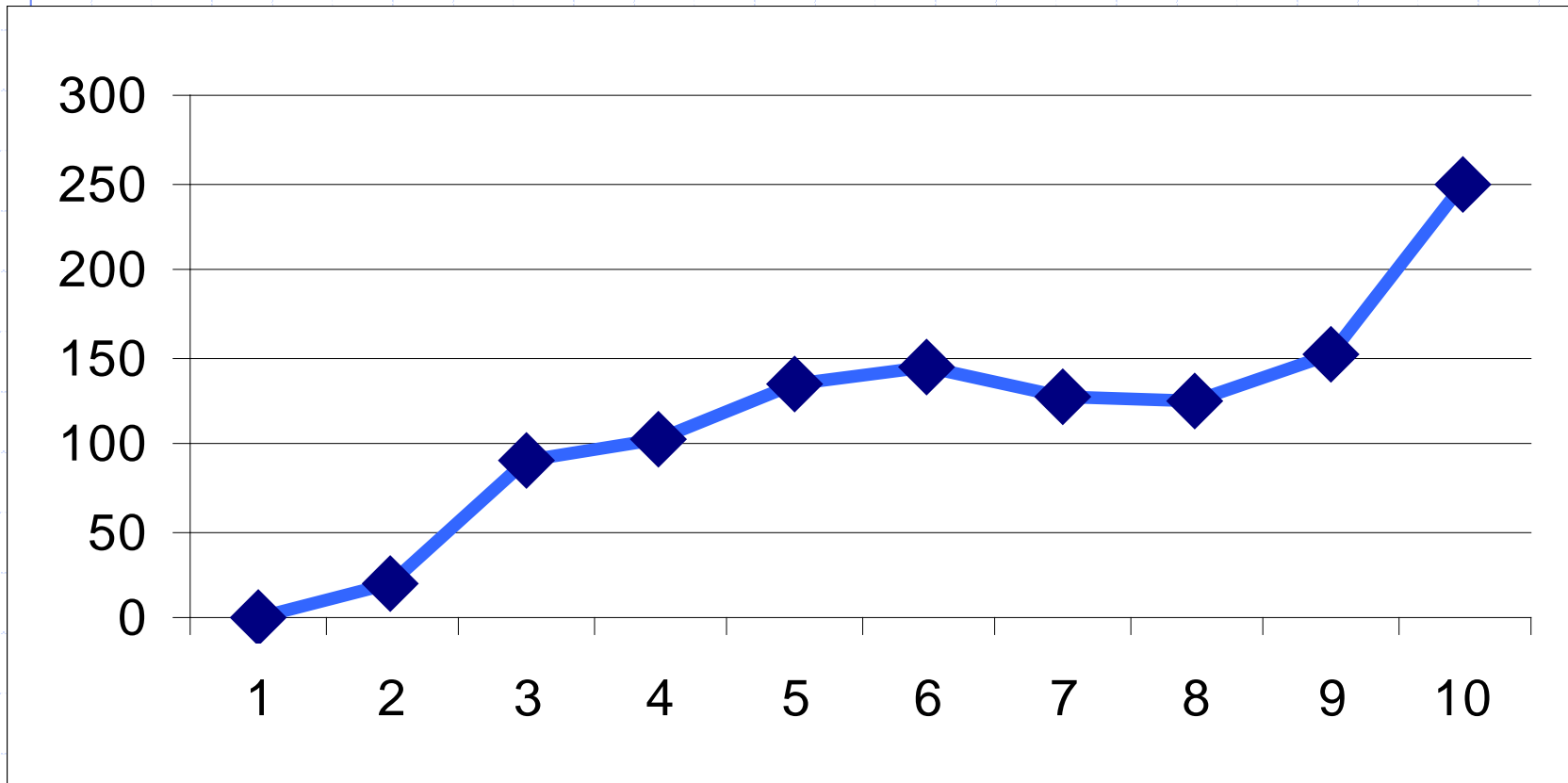
Volatile Acids: Low to High to Low



Sour Digester September 2010

- ◆ Stabilize digester chemistry
- ◆ Realize that the whole process depends on microorganisms that work great under certain circumstances
- ◆ Once digester stabilized, develop a way to prevent a future upset
- ◆ First upset digester in over 10 years

Biogas improvement, (scfm)



Future

- ◆ Use 2 digesters to handle load to prevent overfeeding



Gas now or later?

1. Human
Digestion 15
hours
2. Anaerobic
Digestion 15
days
3. Landfill
Digestion 15
years

**We can
only
produce
energy
from
options 2
and 3**

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