

Gloversville-Johnstown Case Study: Brown to Green ADG-CHP

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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: how far can we go with ADG???????

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 Industrial 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...

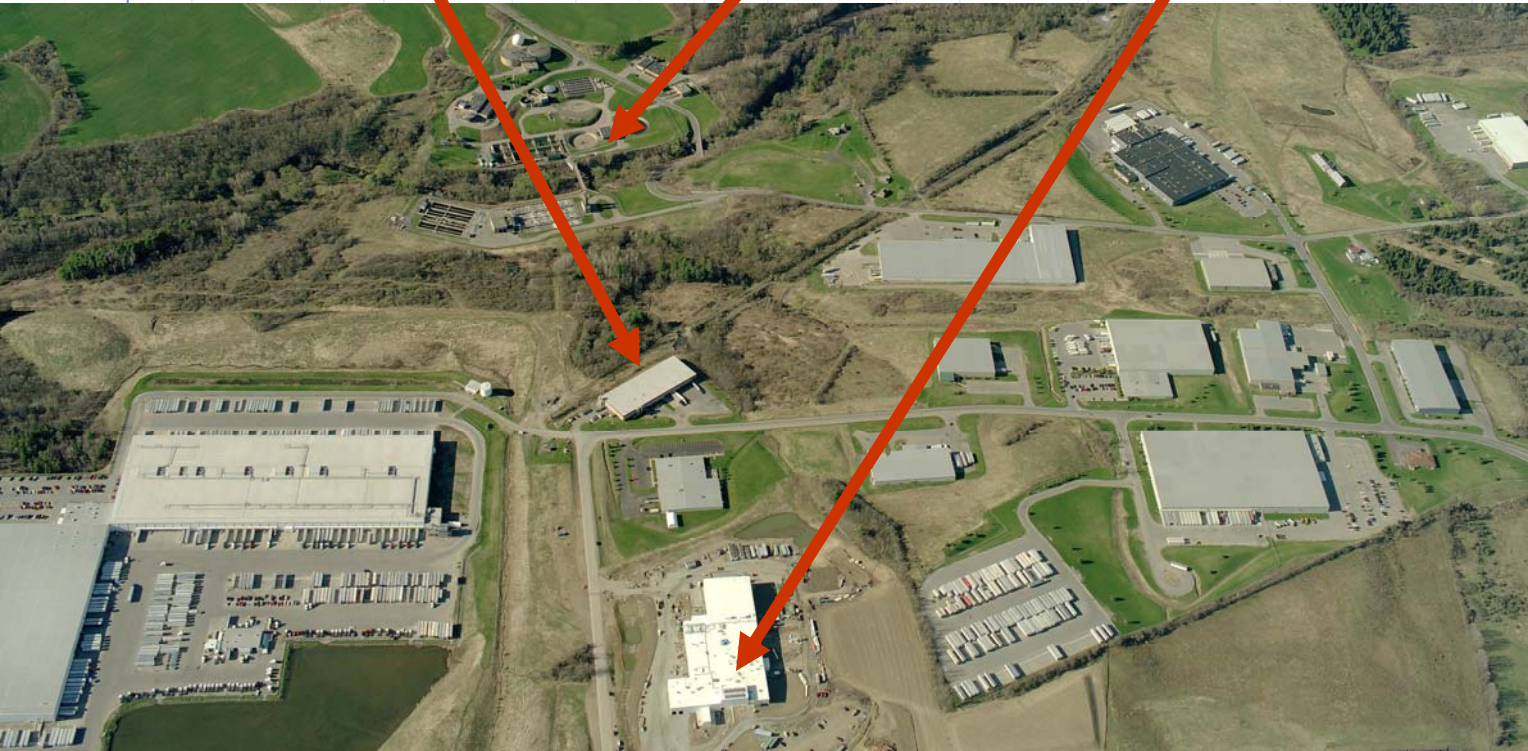


Cheese Plant

Wastewater Plant

Yogurt Plant

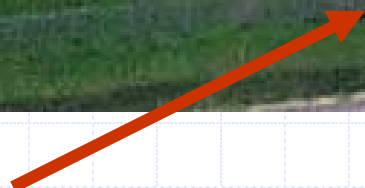
Via Truck



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

Misaligned Failed 90' Cover (loss of valuable fuel, no storage)

West End Flush



East End 18" Down



Secondary Cover Repair

- ◆ Cover fixed in place, no longer floats
- ◆ Gas leaks repaired
- ◆ But no gas storage



Gas Holder...

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



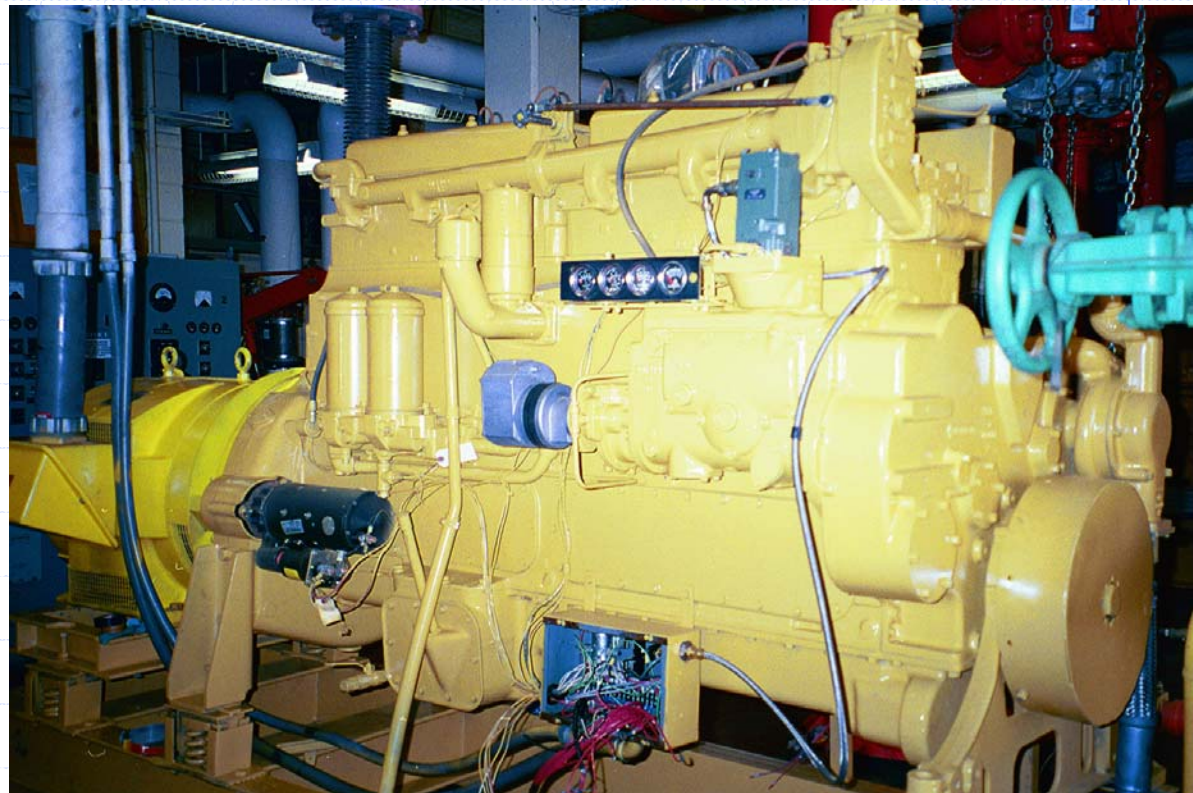
90,000 gallon whey tank

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



Rebuild Engines...

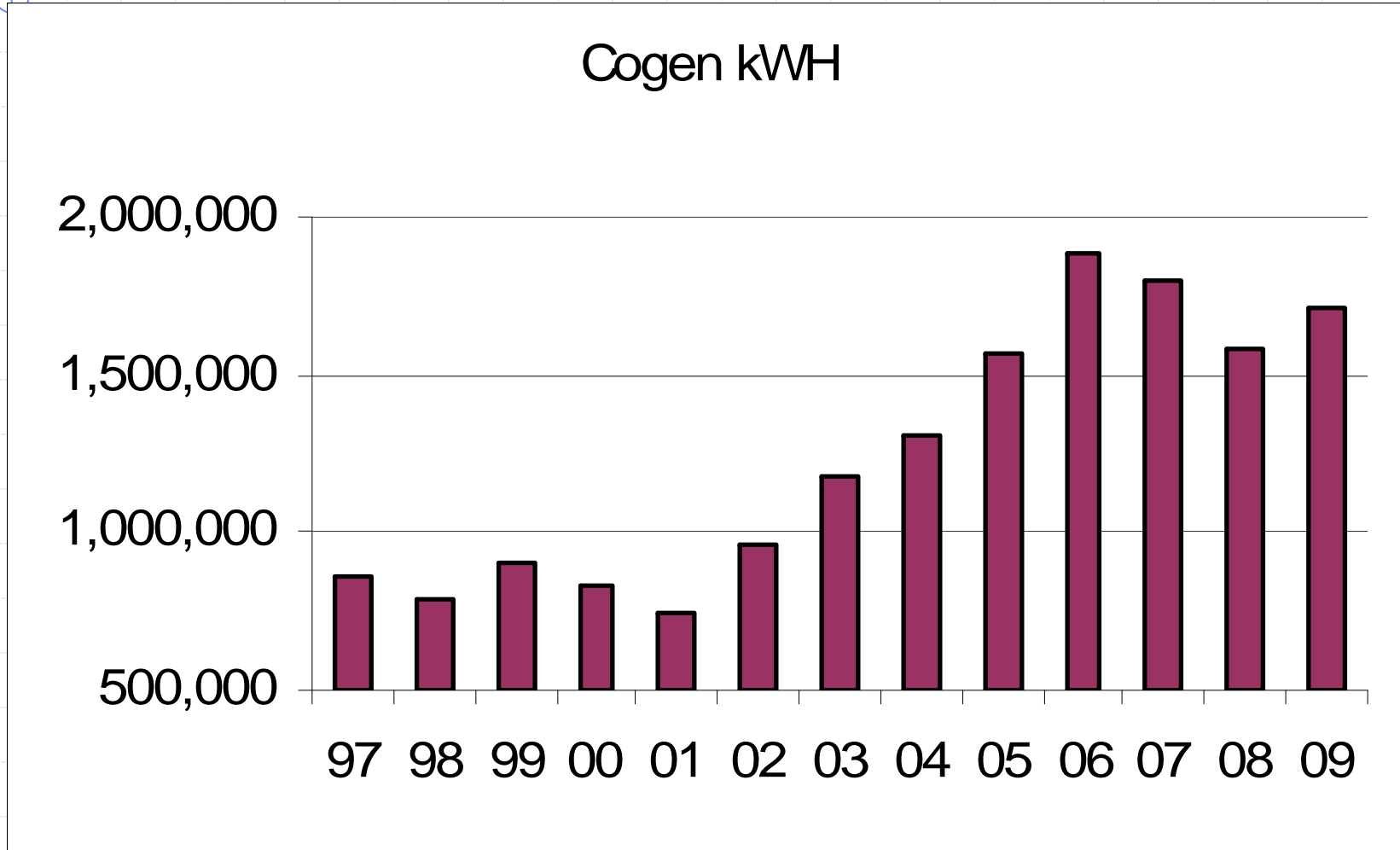
- ◆ 150 KW engines
- ◆ 20 years old
- ◆ Rebuild every 30,000 hours
- ◆ Attempt to keep both running 24/7
- ◆ No backup



2005 Digester project results:

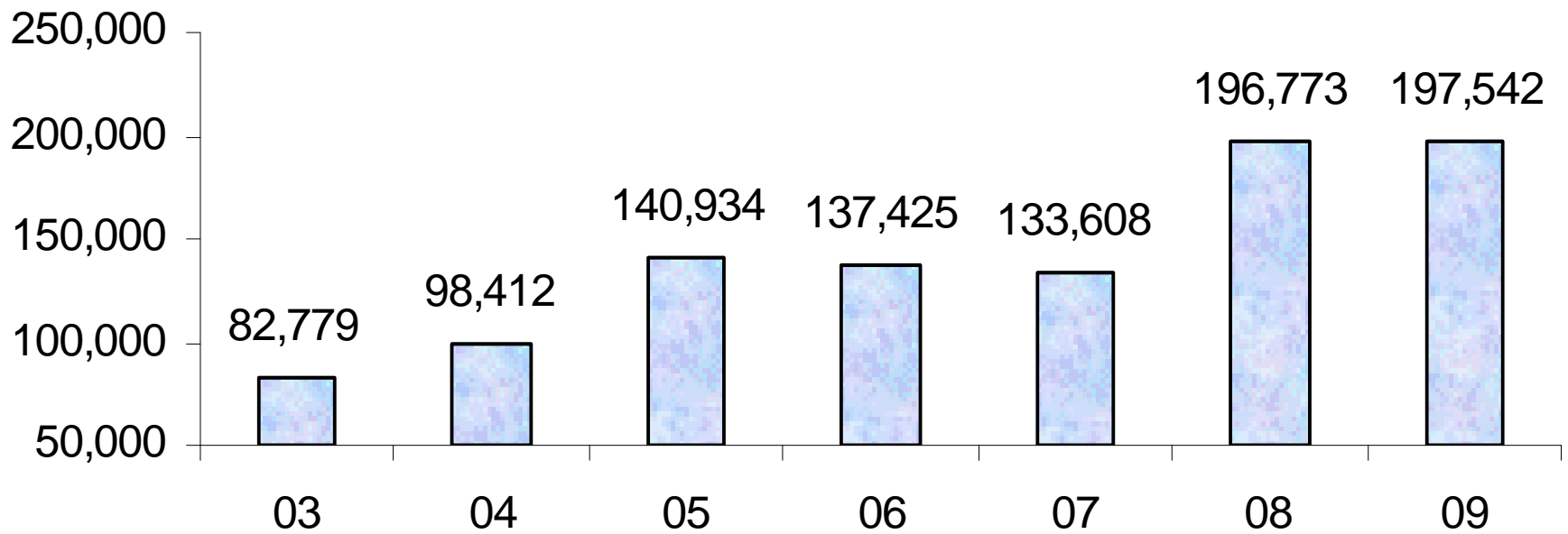
- ◆ Capture and generate more biogas
- ◆ Purchase less electricity and natural gas
- ◆ Generate more electricity
- ◆ Dairy industries now utilizes $\frac{1}{2}$ of the digester capacity...

Double+ output, engines @ max:



Capturing 100% more biogas

Biogas CFD

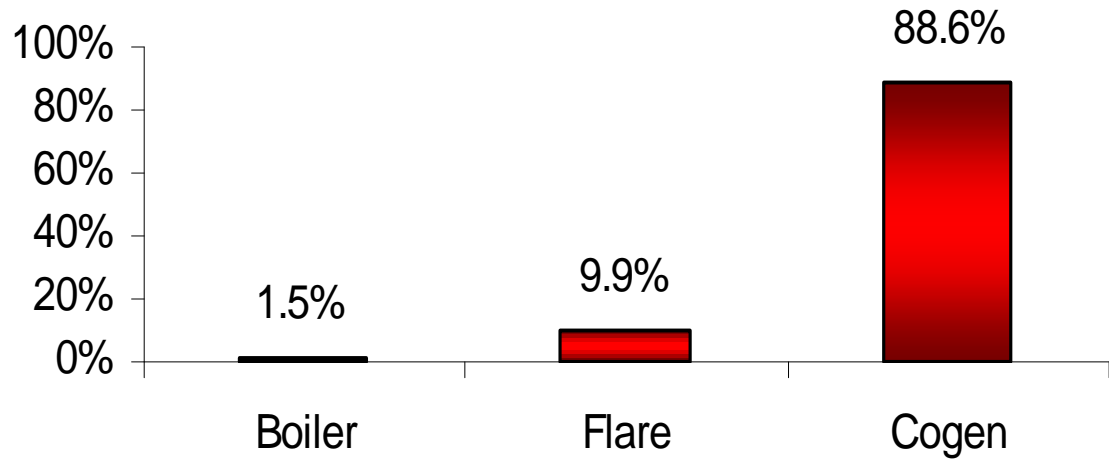


Excess biogas: to flare

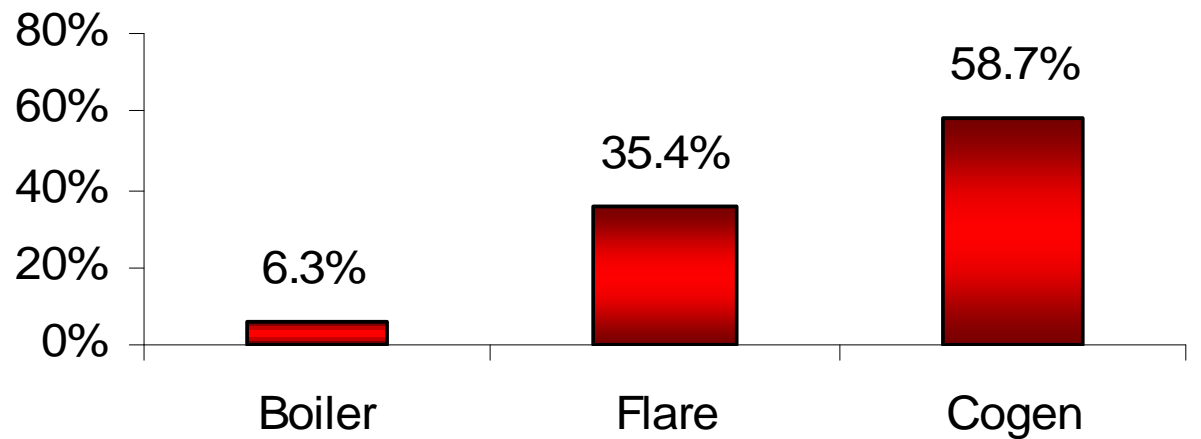
- ◆ If engines and boilers at 100%, no choice but to waste
- ◆ Difficult to get large volume of biogas to the flare when engines not operating
- ◆ Unmeasured biogas: pressure relief valves



Biogas Utilization 2007

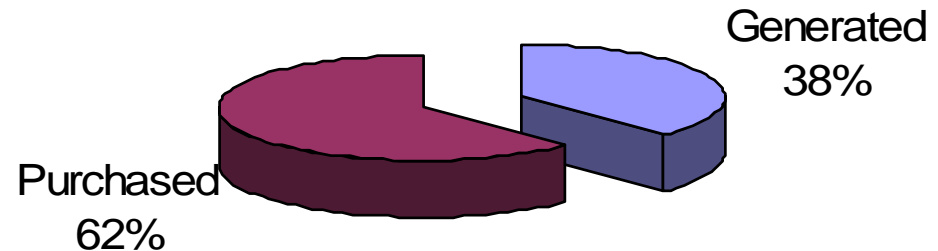


Biogas Utilization 2009



Cogeneration Results:

- ◆ Upgraded system now produces 1.8 million kWh of electricity annually, value \$273,000
- ◆ Currently purchase ~\$400,000 of electricity per year from the grid, and send too much biogas to a flare



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

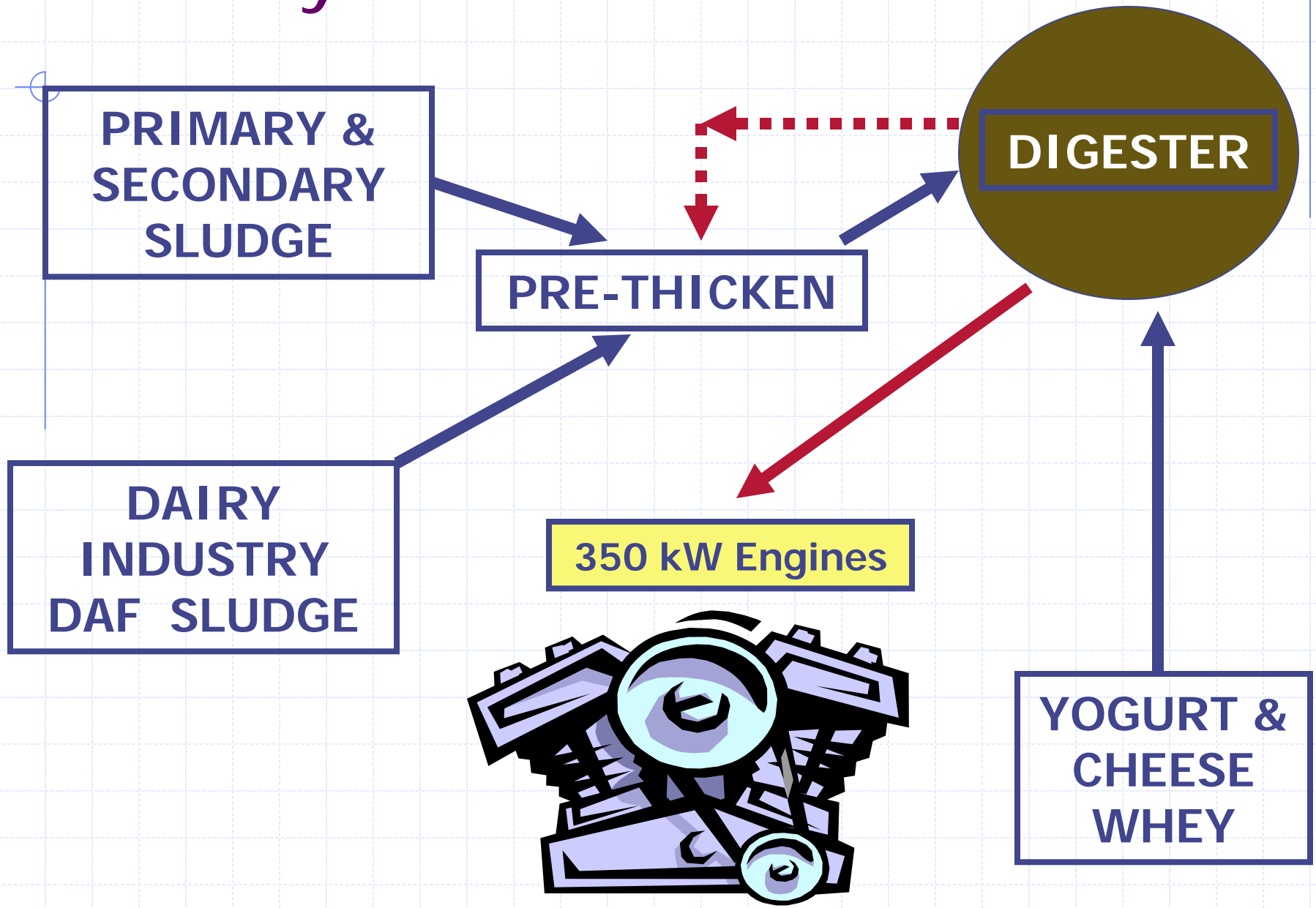
2009 – 2010 Project...

- ◆ Comprehensive \$9.5 million upgrade underway, includes larger generators
- ◆ 350 kW generators manufactured
- ◆ Installation occurring now
- ◆ Operational goal: spring 2010
- ◆ Generator portion ~ \$3 million

300 kW to 700 kW!!!



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, 70,000 gallons sludge, 50,000 gallons whey anaerobic treated each day
- ◆ High strength waste = high biogas generation

Goal: Operational May 1, 2010

- ◆ 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
- ◆ Even if no energy purchased, SC 7 requires payment of standby fees (\$68 K less credit annually)
- ◆ Approach 100% power generated on-site
- ◆ Attempt to eliminate energy bill

Project Financing:

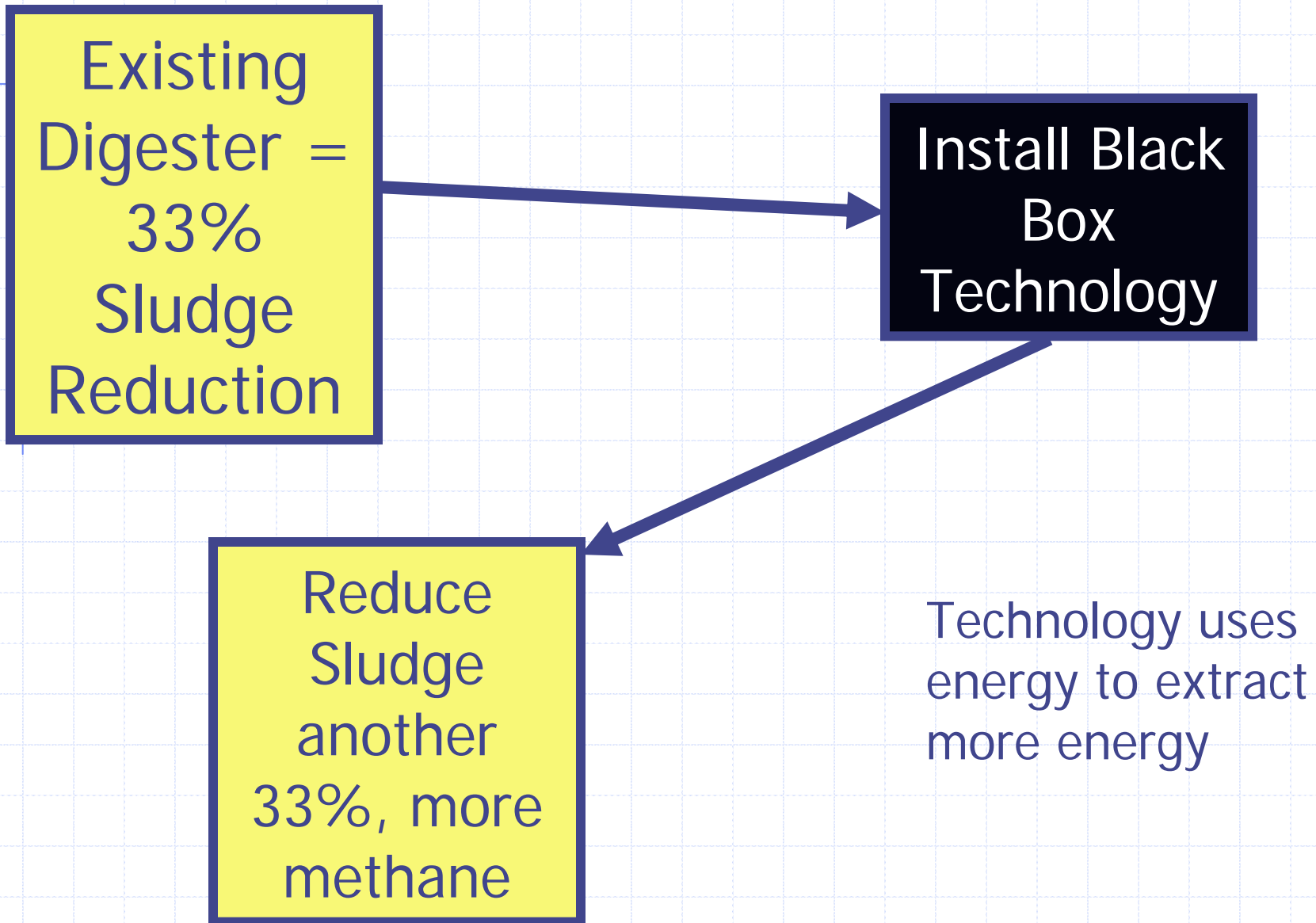
◆ NYSERDA (ADG to electricity)	\$1.0 M
◆ NYSERDA (demonstration)	\$0.4 M
◆ EDA (job growth)	\$2.2 M
◆ EFC (GIGP, Stimulus)	\$4.9 M
◆ Local funding	<u>\$1.0 M</u>
◆ Total Project cost	\$9.5 M

Lessons Learned:

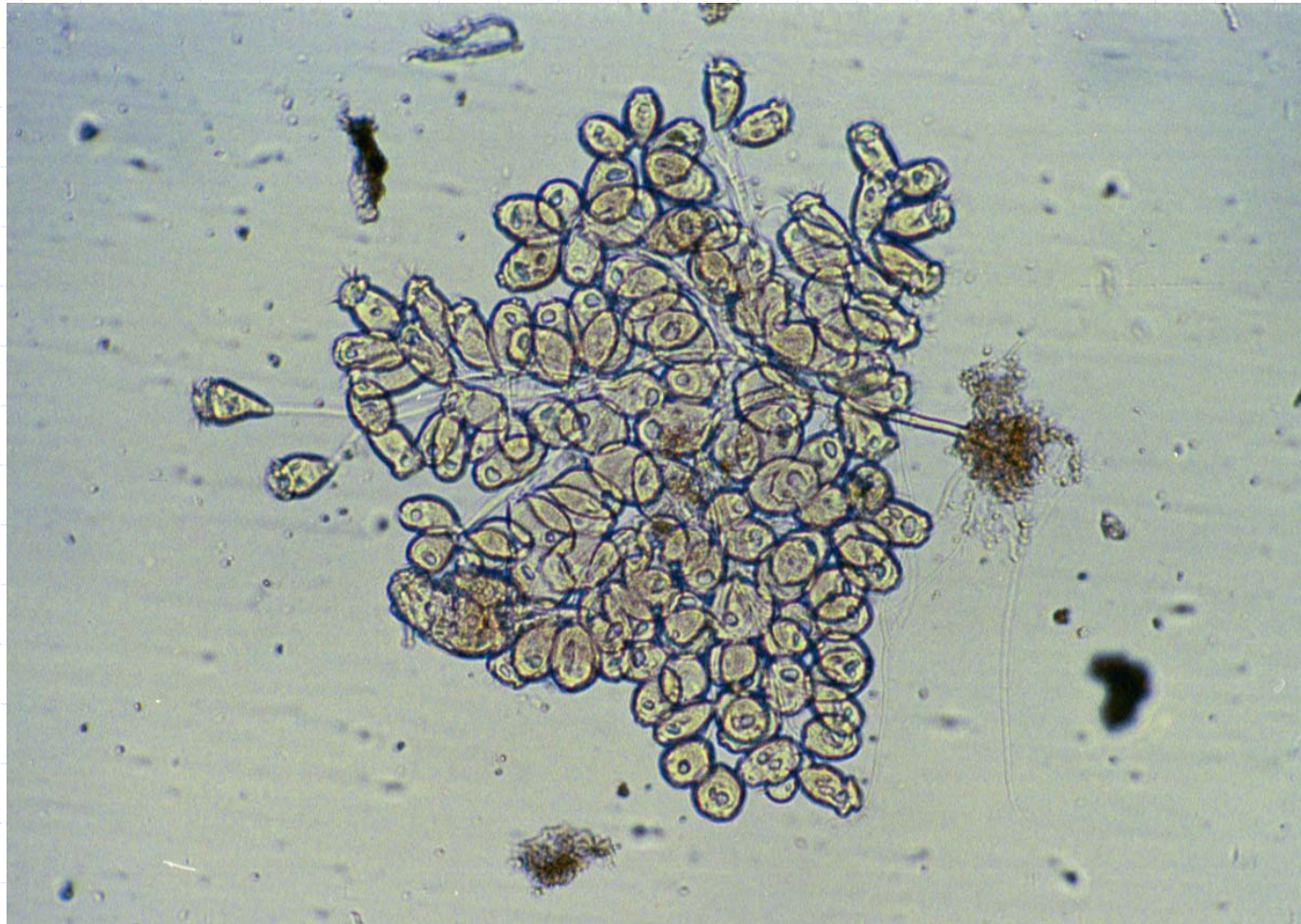
- ◆ Water water everywhere!
- ◆ Freezing of PRV
- ◆ Biorock grows in system!



The Future?



Destroy cell membranes...



Gas now or later?

- ◆ Human
Digestion 15
hours
- ◆ Anaerobic
Digestion 15
days
- ◆ Landfill
Digestion 15
years



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