

Anaerobic Digestion with Combined Heat & Power



Clayton (Mac) Richardson, P.E.
Lewiston-Auburn Water Pollution
Control Authority (LAWPCA)

LAWPCA

- Wastewater treatment facility servicing the communities of Lewiston and Auburn
 - Chartered in 1967 by the Maine Legislature
 - Population – 60,000 people
 - Processes 3.2 billion gallons (2015)
 - Provide Septic Waste Treatment for 24 additional towns (83,600 population)
- Administration – quasi-municipal agency

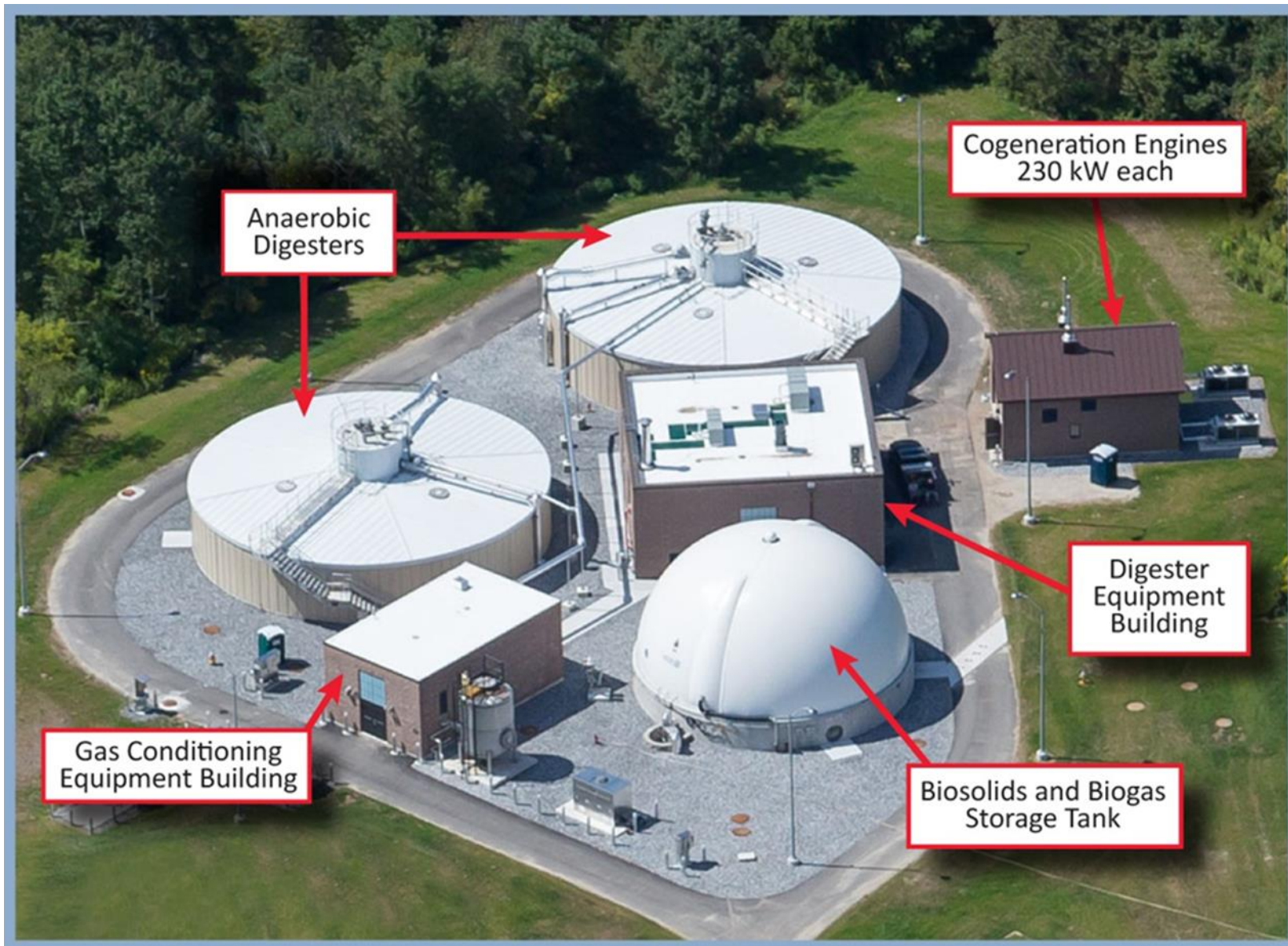
General Information on Anaerobic Digestion at WWTFs

- Naturally occurring microbes digest organics in the absence of oxygen
- Used for over 100 years at sewage treatment plants
- Reduces solids volume and produces methane rich digester gas as a byproduct
- 20% of U.S. WWTF have anaerobic digesters but only about 3% use the gas to make electricity
- WWTFs use 2-3% of the US's total electricity output



LAWPCA: Basic System Stats

- Activated sludge TP 14 MGD(des)/8.5 (avg 2015)
- Two primary mesophilic digesters 0.7 MG ea fixed covers, straight sidewalls rotomix system
- Digestate and biogas storage tank (168k gallons and 33K ft³)
- Two 230 kW Liebherr Co-generation engines
 - Burn biogas (byproduct of treatment process) to supply 45% of the facility's electricity needs
 - Waste heat from engines used to maintain temperatures of the anaerobic digesters (95-98 degrees Fahrenheit)
- H₂S removal –iron sponge, Siloxane future
- Temporary feedstock receiving station



Crazy Ideas and Rational Decisions

- First proposed to Board of Directors Sept. 2008
- Words and Examples from Biosolids Professionals
 - Jeffrey Pinnette and Jamie Ecker
- Feasibility Study by Respected Consultant (CDM)
- Capacity and Cost of Existing Biosolids Program
- Risk Tolerance and Entrepreneurial Spirit
- Value Engineering Study – Delay co-gen engines/electricity production facilities.
- Timing in Life is Everything! (no ARRA funding)

Project Cost and Funding

- Total Cost approximately \$15,000,000
- Maine State Revolving Loan Fund
 - 1% interest rate 20 year bond
 - \$825,000 in Principal forgiveness
- \$330,000 Efficiency Maine Grant (for Co-gen engines)
- \$600,000 per year in annual Operational Savings
- Retired Bond for Composting Facility
- All above combined = *no rate increase!*



Sure. A pretty picture, but aren't we supposed to be using that gas?

Energy Consumption and Biosolids Production

- 2008 Reference year (prior to great recession)
- Average biosolids production 2,178 cubic yards/mo
- Average Monthly Power: 300,000 kWh = \$35,000
- Current Levels (data also reflects industry shut down)
- Average biosolids production 875 cubic yards/mo
- Average Monthly Power: 155,000 kWh = \$18,050
- Other factors impact both items.
- 100% Beneficial Biosolids Use—Compost, Farm Fertil.

What's Next?

Feedstocks: The Holy Gruel

- Gruel: A thin, easily digested soup
- Repurpose 15K gallon Septic Receiving Tank
- Strength and measuring gas potential
- Markets and Pricing
- Toxicity
- Plugging and handling issues
- Balancing Benefits, Expectations and Problems
- Benefits to Maine Communities and Business

Conclusions

- Efficiency Maine grant allowed cogeneration
- Greenhouse Gas and Environmental Benefits
- Long term capacity and user rate stability
- Support for local economy
- Role in Maine Waste Hierarchy
- Moving toward net energy neutrality