



Harnessing Energy from Wastewater

September 2017

WLSSD's Combined Heat and Power Energy Project

Along with clean water, Western Lake Superior Sanitary District's (WLSSD) wastewater treatment facility can produce clean, renewable energy. Biogas, a methane-rich byproduct of the treatment process, can be used to create electricity and heat. WLSSD's Combined Heat and Power energy project will allow WLSSD to use the biogas currently produced at its regional wastewater plant to

generate more than a third of the electricity needed to power the treatment plant.

WLSSD also plans to reclaim additional wastes to increase biogas production. Investing \$29.5 million over 5 years, WLSSD can cut electricity purchases in half or more—moving WLSSD toward its goal of energy neutrality.



WLSSD's Vision: Energy Self-Sufficiency

WLSSD envisions an energy neutral future by generating 100% of the electricity needed to operate its large regional wastewater treatment plant. The unpredictable nature of energy costs remains WLSSD's biggest challenge in its efforts to stabilize rates for area residents and employers. Every day, WLSSD currently produces enough biogas to generate 35% of the electricity needed to operate the treatment plant. WLSSD is currently able to use a portion of this gas for heating, but unused gas is flared off and wasted. WLSSD's three-phased plan to produce and use energy on site by fully using this existing, renewable resource will allow WLSSD to control costs, stabilize rates, and improve WLSSD's reliability and resiliency.

Phase 1: Electrical distribution modifications and installation of engine generators, \$16.43 million

Phase 2: Heat exchanger and heating and ventilation modifications, \$7.77 million

Phase 3: Increase gas production with the addition of reclaimed high strength wastes, \$5.43 million

At a Glance:

Western Lake Superior Sanitary District Combined Heat & Power Project

Project Timeline:

2017-2018: Improve electrical distribution and install generators

2018-2019: Improve heat exchangers and heating/ventilation

2019-2020: Increase gas production with reclaimed high-strength wastes

Total Project Cost:

\$29.5 million

Technologies:

825 kW engine generators

Gas conditioning for siloxane, moisture and H₂S removal

Modular boiler system with

- 3 boilers that operate on biogas or natural gas
- 6 boilers that operate on natural gas or fuel oil

Market Value of biogas currently produced:

\$1,000—2,000 daily

Expected Results:

Reduce WLSSD electricity purchases by half

Annual savings of \$1.04 million*

Annual reduction of 11.85 million kW electricity used*

Reduced emissions (see back page for details)

(*based on 2018 electricity rates and use)



Wastewater Treatment is Energy Intensive

Similar to many wastewater facilities, purchased electricity has become the largest non-payroll cost in WLSSD's wastewater operations, driving tough budgetary decisions and increased rates to customers. At about \$3 million annually, electricity accounts for about a third of wastewater treatment plant operating costs.

Electricity rates continue to rise—about 5-9% each year. WLSSD has reduced its electricity consumption by 18%, but has only realized 6% in cost savings as a result of rapidly increasing electricity rates.

WLSSD Electricity by the Numbers

- **\$3.1 million** in annual electricity costs
- **A third** of treatment plant operating costs
- **66.4% increase in electricity rates** since 2006
- **34,341,057 kWh** used annually
- **Investing \$29.5 million over 5 years**, WLSSD can cut electricity purchases **in half** or more.



A Strategic Investment in Efficiency

WLSSD is uniquely positioned to serve the region by providing both wastewater treatment and cogeneration of renewable energy with the use of engine generators. Engine generators are the longest standing form of biogas utilization for electricity production, dating back into the 1970s.

WLSSD already produces the methane-rich biogas needed to generate about 35% of its power needs. After removing contaminants, WLSSD will utilize this renewable resource that would otherwise be wasted.

Overall, engine generator installations are 75-85% efficient for energy recovery; a large portion of the heat from the generators can be captured and used. Engine generators can also handle small fluctuations in biogas production. Biogas can also be stored to dampen peak gas production conditions.



WLSSD's Energy Plan is Underway

- 15 years successful production of biogas in our \$30 million, 4-million gallon anaerobic digestion facility along with thermal improvements to improve facility heating. WLSSD uses only about half of its digester capacity.
- Successfully using biogas to meet 8% energy needs
- Reduced electrical use by 18% with operational efficiencies
- \$11.2 million heating conversion and gas conditioning upgrades in 2015



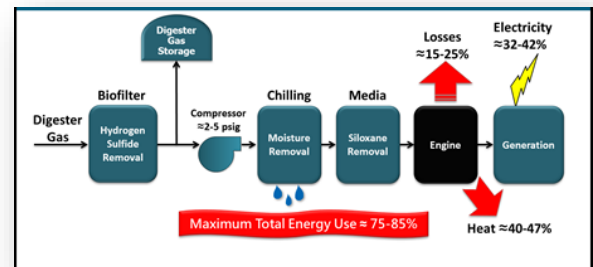
5-Year Path to Energy Self-Sufficiency

WLSSD will become energy neutral in three planned phases—reducing variability in operating costs, and improving the environmental footprint of the campus. Investing \$29.5 million over 5 years, WLSSD can cut electricity purchases in half or more.

Phase 1 – 2017-2020: WLSSD will install two 825kW engine generators that use biogas to generate electricity and improve the electrical distribution system. Using the biogas currently produced, WLSSD will meet about 35% of its power needs. WLSSD will also recapture the substantial heat produced by the generators for use in the treatment process and for building heat, reducing the need for purchased natural gas.

Estimated cost \$16.43 million.

Phase 2– 2019-2021: WLSSD will reduce its overall energy consumption by modifying the plant heating and ventilation systems, and improvements to the digester heat exchangers and heat recovery. Components of this phase will reduce the wastewater treatment plant's electrical demand and improve system reliability. **Estimated cost \$7.77 million.**



Phase 3 – 2020-2021: WLSSD will increase biogas production and electricity generation by directly adding high strength wastes such as fats, oils and grease and food waste into WLSSD's anaerobic digesters. With increased biogas from wastes, WLSSD will generate electricity to meet 50-100% of treatment plant electricity needs. WLSSD's existing digester capacity allows for production of biogas and electricity to become energy self-sufficient. **Estimated cost \$5.34 million.**



Harnessing Energy from Wastewater Yields Great Benefits

- Maximizes the use of existing infrastructure
- Generation of reliable, cost-effective renewable energy
- Reduces emissions
- Stabilizes rates for residents and businesses
- Uses existing energy resource that is currently wasted

Potential Annual Emissions Reductions Resulting from WLSSD's Engine Generator Project	
CO ²	21,000,000 pounds
NO	17,000 pounds
SO ²	20,000 pounds
Mercury	160,000 mg

Source: Based on MN Power 2013 emissions profile.



WLSSD—A Comprehensive Solution to Regional Problems



Western Lake Superior Sanitary District is a special purpose unit of government created by the Minnesota Legislature in 1971 to address serious environmental pollution problems in the lower St. Louis River basin. The organization is responsible for the effective and economical treatment of wastewater and management of solid waste for a 530-square-mile region in northeastern Minnesota, providing services to 17 communities and four large industrial facilities. The dual role of managing wastewater and solid waste for the region makes it possible for WLSSD to offer collaborative solutions to the challenges posed by waste in our society. WLSSD programs have been recognized nationally for innovation and effectiveness while preserving and protecting the unique natural characteristics of the region.

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