



## PROJECT PROFILE

# Southwest Wastewater Treatment Plant (Springfield, MO)

## 2.4 MW Biogas CHP System



### Project Overview

The City of Springfield, MO provides wastewater collection and treatment for the city and surrounding communities, servicing around 200,000 people. The Southwest Wastewater Treatment Plant is the larger of the two wastewater treatment plants in Springfield. It treats an average of 30 million gallons per day (MGD) and processes the biosolids from both locations. The plant treats the primary solids, waste solids, and hauled fats, oils, and grease (FOG) through anaerobic digestion.

The City expanded the biosolids treatment process at the Southwest Plant beginning in the fall of 2016. The expansion improved solids handling and thickening, and increased digestion. The original digestion process utilized four single stage anaerobic digesters. Two new digesters were installed converting the process to one acid phase digester followed by three first stage gas digesters and two second stage gas digesters. The new acid/gas digestion system generates an average of 350 scfm of biogas containing 60% methane. The biogas generated from the anaerobic digestion process fuels two new combined heat and power (CHP) generators in addition to the existing boilers.

In 2019, the City added two 1.2 MW reciprocating engines with 4.27 MMBtu/hr of heat recovery each to take advantage of the increased biogas. One of the digesters was retrofitted with a flexible membrane to store the gas, which is cleaned to remove H<sub>2</sub>S, siloxanes, and moisture prior to feeding it to the generators and boilers. The recovered thermal energy heats both the digesters and the site building in cold weather. The power generated supplies about 50% of the plant's electrical needs. The biogas supplies around 60% of the fuel for the engines. Natural gas will make up the remainder of the fuel until economic growth and increased processing of high strength waste generate enough biogas to fully fuel the engines.

### Quick Facts

- LOCATION:** Springfield, MO
- MARKET SECTOR:** Wastewater Treatment
- FACILITY SIZE:** 30 million gallons/day avg., 100 MGD peak
- CHP GENERATION CAPACITY:** 2.4 MW
- PRIME MOVER:** Two 1.2 MW CAT CG170-12 reciprocating engines
- CHP HEAT RECOVERY RATE:** 8.5 MMBtu/hr
- USE OF THERMAL ENERGY:** Heating the digester and building
- CHP FUEL SOURCE:** Anaerobic digester biogas, natural gas
- PROJECT COST:** \$5.8 Million
- ANNUAL SAVINGS:** ~\$1.0 Million
- BEGAN OPERATION:** 2019

### Project Drivers

The project was driven by the need for increased solids processing capacity and a desire by the City to increase its use of renewable energy and its overall energy efficiency. The CHP system operates at a total thermal and electrical efficiency of over 82%. During the upgrades, the digesters were also retrofitted with vertical liner motion mixers to replace the previous draft tube mixers, reducing power for digester mixing by 75%. Power monitoring was also installed throughout the plant to look for other ways to reduce energy use.



**Aerial View of Southwest Wastewater Plant**  
Photo Courtesy of City of Springfield

## Project Economics



**1.2 MW CAT Engine (CAT CG170-12)**  
Photo Courtesy of City of Springfield

Negotiations with the City Utilities of Springfield resulted in an arrangement allowing credit for 90% of the plant's power generation. Electric meters were installed at each engine to facilitate this, but total electricity continues to be metered at the substation. Economic benefits from the project include approximately \$600,000 annual credit for power generation, \$150,000 in avoided natural gas costs, and up to \$280,000 in reduced demand charges, depending on system performance. Southwest Wastewater Treatment Plant currently plans to have maintenance performed by a third-party, but long-term plans are in place to transition to in-house maintenance for the installed genset.

The project was self-funded through bonding and sewer billing. The capital costs included \$3.3 million for the engines and heat recovery units, plus an additional \$1.5 million for the digester membrane and biogas conditioning. The energy production is bringing annual savings of approximately \$1 million through reduced power purchases, lower peak demand charges, and reduced natural gas for heating.

### *Project Costs*

CHP equipment	\$3,356,000
– Recip engines/heat recovery units	
Digester membrane	\$440,000
Biogas conditioning	\$1,043,000
O&M (est. annual)	\$150,000

### *Project Savings*

Annual credit for power gen	\$600,000
Avoided natural gas costs	\$150,000
Reduced demand charges	up to \$280,000



**Anaerobic Digester and Gas Cleaning Equipment**  
Photo Courtesy of City of Springfield

*“Through biogas power generation and reduced energy usage, the Department has taken a big step towards its goal of net-zero energy at this facility.”*

*- Errin Kemper, Director  
Springfield Environmental Services*

## For More Information

### U.S. DOE CENTRAL CHP TECHNICAL ASSISTANCE PARTNERSHIP

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*The Central CHP TAP is a U.S. DOE sponsored program managed by the Energy Resources Center located at the University of Illinois*