PROJECT PROFILE

Danville Sanitary District

150 kW Biogas CHP System

Project Overview

The Danville Sanitary District, located near the Indiana border about 130 miles south of Chicago, is a 24 million gallon per day (MGD) facility that averages 16 MGD and services a population of over 33,0000 residents. The Danville Sanitary District (DSD) runs a tertiary treatment system which utilizes anaerobic digestion to stabilize the bio solids prior to land application. The Danville treatment system also incorporates a CHP system installed in April of 2013 to operate in conjunction with their three anaerobic digesters. The CHP system uses a 150 kW internal combustion engine generator to generate electricity from the biogas produced from the anaerobic digester that offsets normal plant electric consumption. Waste heat generated by the IC engine is used to heat the digester system, reducing the facility's dependency on local natural gas.

Quick Facts

LOCATION: Danville, Illinois
MARKET SECTOR: Wastewater Treatment
FACILITY SIZE: 16 MGD
PRIME MOVER: Internal Combustion Engine
FUEL: Anaerobic Digester Biogas
BIOGAS CONDITIONING EQUIPMENT: Unison Solutions Conditioning Skid
USE OF THERMAL ENERGY: Heat for anaerobic digester/building heat
OPERATION: 24/7
ELECTRIC OUTPUT: 150 kW
THERMAL OUTPUT: 778 kBTU/hr
ELECTRIC SAVINGS: 3,600 kWh/day
THERMAL SAVINGS: 186.7 therms/day
TOTAL PROJECT COST: $750,000
STATE DCEO GRANT: $225,000
PAYBACK: 5.2 years with grant
BEGAN OPERATION: 2013

Focus on Sustainability

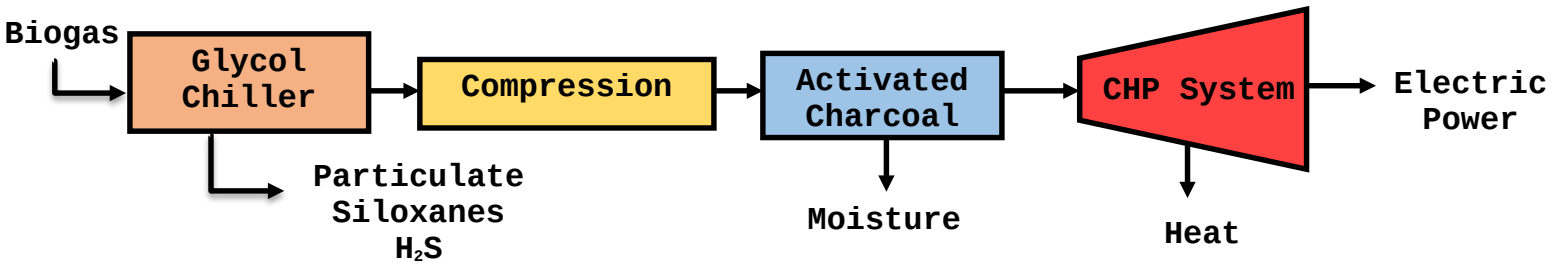
Although not consistent, biogas production is continuous throughout the day. Typically, the biogas, which consists mostly of methane, is flared off to reduce its environmental impact. Danville Sanitary District decided to utilize the biogas before it is flared to run a combined heat and power system. DSD has been actively working towards becoming a net-zero facility. The installation of the CHP system was a pivotal step in this goal. The system offsets electric use in the facility by approximately 20%.

Production of Gas

Solids collected by the sewers from the residential, industrial, and commercial districts are sent to the sanitary district where they are separated from the accumulated liquids. The separated solids, or sludge, is pumped into three above-ground, anaerobic digesters. Microbes in the tanks consume the organic matter present in the solids, stabilizing the sludge and producing a methane gas mixture known as biogas. The composition of the biogas varies depending on the quality of sludge the plant receives, though it is primarily methane with large amounts of carbon dioxide and water. Other constituents typically found, albeit in much smaller quantities, are hydrogen sulfide, siloxanes, and other hydrocarbons.

Tom Stone, an Environmental Specialist and Civil Engineer with DSD, leads a group on a tour of the CHP system.

CHP Equipment & Configuration



Operations:

The digester gas enters the gas compression/moisture removal skid, created by Unison Solutions, where it first is cooled down and compressed so moisture can be removed. The gas then enters a silo containing activated charcoal media that will remove many of the biogas constituents. Once the biogas is conditioned, it will be sent into the Tech-3 G6-150 generator engine. The glycol chiller and small compressor add parasitic loads to the system, but together they use less than 5% of the total energy produced. The rest of the energy is used within the facility.

Gas Conditioning Skid

Tech-3 G6-150 Engine

CHP Operation

The 150 kW CHP system is designed to run 24 hours a day, 7 days a week with an availability rate of well over 90%. The system was sized off of the biogas production from their anaerobic digester. The heat recovered from the CHP system is converted into usable hot water, which is then used for facility space heating and for the heat exchanger to maintain the temperature of the anaerobic digesters sludge. The digesters must be kept at a temperature of ~97 ˚F for the anaerobic bacteria to thrive and produce the maximum amount of gas. The push to utilize their wasted biogas forced DSD to update their gas flaring system in order to meet the conditions imposed by the CHP system. A new automatic igniter on the flare needed to be installed, and a new flame arrestor put in. Other operational issues have arisen, but the staff works diligently to ensure the continuous use of the system.

The system electrically offsets 150 kW saving $70,956/yr while concurrently offsetting close to 100% of the facility's natural gas needs, amounting to savings of approximately $30,000 each year. More heat is currently being produced with the system than is needed by the facility, resulting in waste heat being sent to the dump radiator and lost to the atmosphere. The total project cost was approximately $750,000. The facility received a $225,000 grant from Illinois' Biogas and Biomass Program. The receipt of the grant funds and the realization of the savings will reduce the simple payback to just over 5 years.

For More Information

U.S. DOE MIDWEST CHP Technical Assistance Partnership
1309 South Halsted Street (MC156)
Chicago, Illinois 60607-7054
Phone: (312) 996-4382
Fax: (312) 996-5620
www.MidwestCHPTAP.org

"What's not to like about using sewage to generate heat and electricity while also reducing gas emissions into the atmosphere?"

- Tom Stone, Engineer