



Albert Lea Wastewater Treatment Facility

120 kW Biogas CHP System

Project Overview

In the summer of 2003, the Municipal of Albert Lea Minnesota installed a 120 kW CHP system at their wastewater treatment facility. The system integrates four Capstone C-30 microturbines and utilizes the recovered heat from the turbines to both maintain the proper operating temperature of the anaerobic digester and provide a portion of the facility's space heating requirements. The microturbines operate on methane gas created in an anaerobic digester. The anaerobic digester is utilized to treat the wastewater effluent in order to control odors and render the effluent inert.

Background

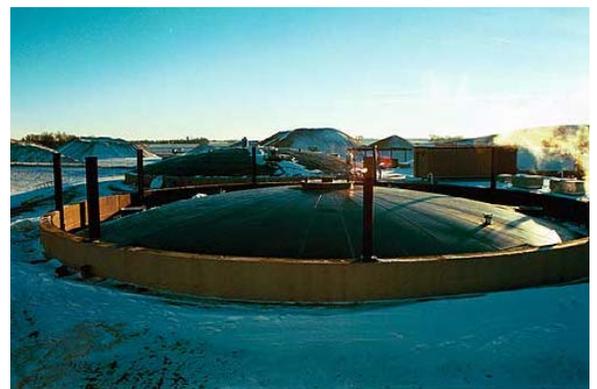
In 2002, Alliant Energy, a leading power distributor in the Midwest, partnered with customers that could benefit from renewable energy as part of a state Conservation Improvement Program, co-sponsored by the Minnesota Department of Commerce. Wastewater treatment centers are ideal facilities for microturbine CHP applications due to the availability of digester gas created from the waste effluent. An alternative option to flaring digester gas is utilizing it as a fuel in a boiler; however, the low Btu gas can be put to a much more efficient and profitable use in a CHP system. The fuel flexibility of a microturbine based CHP system allows the digester gas to be utilized to generate a portion of the facility's electric requirements, with the exhaust heat from the microturbine used to satisfy a portion of the facility's heating requirements. The Albert Lea Wastewater Treatment Facility was determined to be a prime candidate for a microturbine installation, and today, because of the partnership arrangement between the Municipality, the local electric utility and the State Energy Office, the CHP system is saving energy and reducing air pollution.

CHP System Operation

The installed CHP system generates approximately 800,000 kWh per year, 25% of the treatment center's typical annual electric consumption, fueled by biogas produced in the anaerobic digester. The biogas is first conditioned to remove impurities, leaving methane to be burned in the microturbines. This is accomplished by sending the gas through a suction scrubber, a scroll gas compressor, carbon filter vessels for siloxane removal, and then cooling the gas to remove moisture.

Quick Facts

LOCATION: Albert Lea, Minnesota
MARKET SECTOR: Wastewater Treatment
CHP GENERATING CAPACITY: 120 kilowatts
EQUIPMENT:
 (4) 30 kW Capstone Microturbines
FUEL: Anaerobic Digester Biogas
HEAT RECOVERY RATE: 28 MMBtu/day
USE OF THERMAL ENERGY: Heating Anaerobic Digester and Building Space Heat
TOTAL PROJECT COST: \$250,000
PROJECT COST:
 \$76,000 – City of Albert Lea, MN
PROJECT INCENTIVES:
 \$85,000 – MN Dept. of Commerce
 \$89,000 – Alliant Energy
YEARLY ENERGY SAVINGS: \$60,000 to \$90,000 per year
PAYBACK: Less than 2 years



Anaerobic Digester at Albert Lea Wastewater Treatment Facility

PHOTO COURTESY OF THE CITY OF ALBERT LEA



Capstone 30 kW Microturbines

IMAGE COURTESY OF THE CITY OF ALBERT LEA

Waste heat is recovered from the microturbines at a rate of 28 MMBtu per day to provide temperature control of the anaerobic digester and to meet a portion of the buildings' space heating requirements. The system also improves the facility's electrical reliability by providing 120 kW of backup power to operate critical systems in the event of a utility power outage. The system operates with very little vibration or noise and is generally low maintenance, requiring only routine cleaning of the air and fuel filters. Unison Solutions of Dubuque, IA installed the system and maintains it under a 5 year agreement.

The successful integration of the CHP system utilizing a renewable resource fuel yields benefits not only to the wastewater treatment center, but to the municipality and local community. The energy and cost savings reduce costs while improving public profile for the municipality. The microturbines run on the digester gas that would have otherwise been flared and emitted to the atmosphere.

Partnership between Municipal, State, and Utility Entities

Since 1992 Minnesota public electric and gas utilities have been required to spend about 1.5% of their annual revenue on energy conservation improvement programs. Minnesota's Conservation Improvement Program (CIP) includes special programs for homeowners and renters, commercial businesses, manufacturing enterprises, and other industrial customers. CIP provides rebates, grants, energy audits, and education that focus on energy-saving improvements and technologies. Minnesota customers pay for these programs through their electric or gas bills.

With a total installed project cost of \$250,000 for the 120 kW CHP system and annual energy savings from \$60,000 to \$90,000, the CHP project had an estimated simple payback of 4 years. Thanks in part to project cosponsoring from the Minnesota Department of Commerce's

Conservation Improvement Program (\$85,000) and the methane gas compressor provided by the local utility, Alliant Energy (\$89,000), the City of Albert Lea was only required to put forth \$76,000, thus the City experienced a projected simple payback of less than 2 years.

"It gives us the ability to use the methane gas already generated at the plant. We are able to take a waste product and use it for something beneficial."

*- Steve Jahnke,
Albert Lea City Engineer*

"We are impressed with the effectiveness of the technology, and hope to encourage other Minnesota cities to consider capturing methane biogas to not only protect Minnesota's environment, but to save energy."

"The possibilities of the turbines don't end with energy production; they could also bring new businesses, and businesses are looking for cities that have vision."

- Lois Mack

*Conservation Improvement Program Manager,
Minnesota Department of Commerce*

In 2004, the City of Albert Lea received the Minnesota Government Reaching Environment Achievements Together (MnGREAT) Award for the CHP installation fueled by methane gas from the wastewater treatment process. The Governor's MnGREAT Award program recognizes environmental achievements by government employees focusing on the prevention of waste and pollution, the reduction of waste at its source, conservation of energy and water, recycling, and composting.

For More Information

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