PROJECT PROFILE

Ina Road Water Pollution Control Facility

3.3-MW Renewable CHP System

INTERMOUNTAIN CLEAN ENERGY APPLICATION CENTER — U.S. DOE

Site Description

The Ina Road Water Pollution Control Facility is part of the Pima County Wastewater Management District, which treats and disposes of sewage from metropolitan Tucson, Arizona. Built in 1977, Ina Road is a 25 million gallon per day (MGD) plant. Ina Road uses a pure oxygen activated sludge process. The treated, dewatered sludge is applied to non-food agricultural land, and in the future may also be used for mine tailings re-vegetation. Ina Road has never been connected to the electric grid, choosing instead to generate all of its electrical and thermal needs onsite.

Reasons for CHP

Ina Road installed the anaerobic digester and CHP system with the goals of reducing odors, being highly energy efficient (65% or above), and generating 100% of the plant's electrical needs, cooling needs, and heat to the digester.

Quick Facts

LOCATION: Tucson, Arizona
MARKET SECTOR: Wastewater treatment
FACILITY SIZE: 25 million gallons/day (MGD)
ELECTRICITY COST FROM CHP: $0.047/kWh
ANNUAL SAVINGS: $1,260,000
EQUIPMENT: 7 650-kW Waukesha engines with heat recovery, 950-ton absorption chiller
FUEL: Methane produced from the wastewater, natural gas, and propane for backup
CHP CAPACITY: 3,300 kW (1,100 kW from methane, 1,650 kW from natural gas)
USE OF THERMAL ENERGY: HVAC, chilled water, domestic hot water, heating the digester
CHP TOTAL EFFICIENCY: 65%
CHP IN OPERATION SINCE: 1977

CHP System Equipment & Configuration

The CHP system consists of seven Waukesha engine/generator units. Each of the engines runs at about an 85% load factor, or 550 kW. Out of the seven engines, the plant runs five continually, hold one in reserve, and have one under maintenance. This covers the entire load of the plant, and no additional power is required. There is no connection to the Tucson Electric Power grid.

Ina Road Water Pollution Control Facility
Tucson, Arizona

The engines can run on either methane or natural gas. In addition, the plant is required by law to have a backup source of power, and since it is not connected to the electric grid, the plant has on-site propane to use if the natural gas pipeline should fail. They have only needed to use the propane once. Typically, two of the engines run on digester fuel, and the others run on natural gas. "In effect, we're producing on-site about 30% of the fuel consumed each day," notes plant supervisor Gary Blomstrom.

The recovered thermal energy, at 245° F, is used to provide HVAC, chilled water, domestic hot water, and warm water to heat the sludge in the digesters.

Seven 650-kW Waukesha engines

Boilers, located above the engines

CHP Reliability

According to Martin Jones, lead cogeneration power plant operator, "We've had excellent availability, about 98% uptime. This beats what we would get from Tucson Electric Power. Acting as our own utility, we are far superior in terms of reliability and efficiency over the local utility."

"This plant has been producing reliable electricity and heat for more than 25 years, and with the quality of the equipment we have there's no reason why it couldn't continue for another 25," says Blomstrom.

Gas Quality

350,000 cubic feet per day (current)
1,000,000 cubic feet per day (future)
600 BTU per cubit foot
60% methane
40.1% Carbon Dioxide
0.23% Nitrogen
15 ppm Hydrogen Sulfide
0.025% Siloxanes (increasing)

Economics

The electricity from the CHP system costs an average of $0.047/kWh. The plant would otherwise be paying for municipal retail power at $0.11/kWh. Thus, the plant has marginal savings of $0.063/kWh. The CHP system saves the plant $1,260,000 per year. Total savings to date are $13,000,000.

"When everything is factored in, we are producing our energy at a substantially lower cost than any other method known today," notes Blomstrom.

Lessons To Share

- Diligent preventative maintenance is key. If you take good care of the equipment, the facility will run indefinitely.
- Design the power plant system with plenty of future capacity in mind.
- Don't count on automation of the plant – especially for starting and transferring engines.
- Clean digester gas is critical for long-term operation. Methane gas dried to 37 degrees and reheated will eliminate most contaminates.
- Water quality is vital to success in thermal loops.
- Plate & Frame heat exchangers are superior to Tube & Shell types.
- Clean the boilers by hand. Straight passage/dual passage boilers will last ten times longer than others.
- Expect about 40 years of life or more with good care.

For More Information

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