PACIFIC

U.S. DOE

CHP TECHNICAL ASSISTANCE PARTNERSHIPS

PROJECT PROFILE

Eastern Municipal Water District

480-kW CHP System

Quick Facts

LOCATION: Riverside County, California
MARKET SECTOR: Mixed-use Development
TOTAL PROJECT COST: $1,200,000
FACILITY SIZE: 50-acre campus: 110,000 sq. ft. administrative offices, 80,000 sq. ft. maintenance shops and warehouses
FACILITY PEAK LOAD: 1,300 kW
CHP OVERALL EFFICIENCY: 65%
EQUIPMENT: Eight 60-kW Capstone microturbines, 3,000-MBTU/hr. heat exchanger, 150-ton absorption chiller, 300-ton evaporation tower
FUEL: Natural gas
ORIGINAL ENERGY SAVINGS: $300,000 per year
CURRENT ENERGY SAVINGS: $504,000 per year
PAYBACK PERIOD: 4 Years
CHP IN OPERATION SINCE: 2005

Site Description

The Eastern Municipal Water District (EMWD) headquarters operates a CHP system that powers a 50-acre campus. The campus is composed of 110,000 sq. feet of administrative office space and 80,000 sq. feet of maintenance shops and warehouses. The site has eight natural gas-fired microturbines, a heat exchanger and an absorption chiller system.

Reasons for CHP

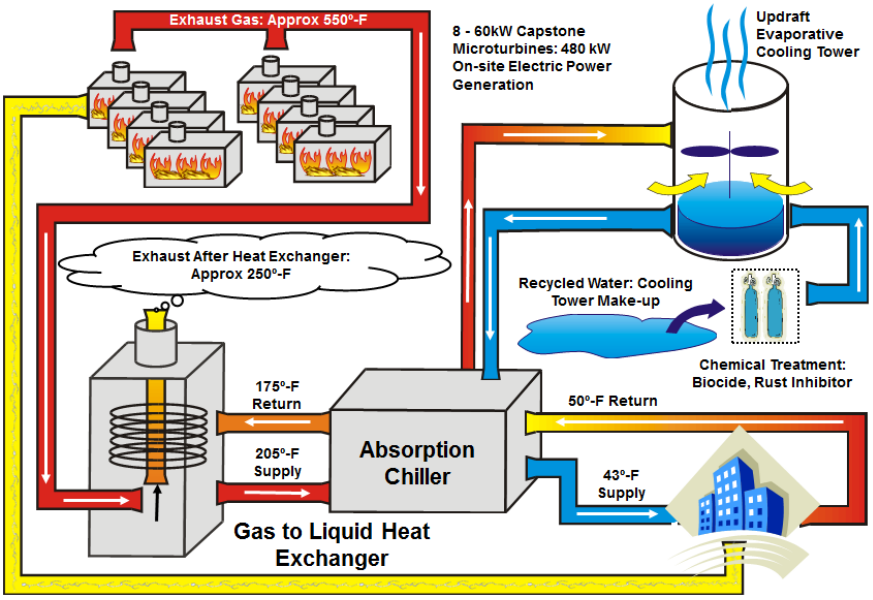
CHP was originally explored for economic reasons, in an effort to reduce high summer peak demand charges incurred by the facility. The facility was also motivated to install a more environmentally friendly power generation system. The system was designed with the intent of:

- Offsetting 480 kW of the facility's 1,300 kW peak load and reducing utility bills through demand charge savings
- Reducing carbon footprint and energy costs by decreasing energy consumption

CHP Equipment & Operation

The CHP system is composed of eight 60-kW Capstone natural gas-fired microturbines, a 3,000 MBTU/hour heat exchanger, 150-ton York absorption chiller and 300-ton evaporative cooling tower. All the recovered heat from the microturbine exhaust is used to power the absorption chiller, which is able to supply approximately 70% of the building's chilled water load on an annual basis. Building heating needs are minimal and are still served by a boiler. Supplemental and backup cooling is supplied by two onsite electric chillers (240-ton and 110-ton) as needed. The adsorption chiller reduces electric demand by about 90 kW.

When the system was first installed, the type of the original gas compressors, as well as the configuration, resulted in poor reliability. Typically, only four to five of the eight turbines would run at any given time. In 2010, this was corrected by installing new gas compressors and changing the compressor arrangement. Four scroll compressors were replaced with a single reciprocating compressor, with a second reciprocating compressor acting as a backup. EMWD was able to use the high-pressure natural gas supply (50 psig) line serving the building. The new compressor was designed to compress natural gas from 50 to 80 psig to replace the old compressor sized for 2 to 50 psig compression. This greatly decreased gas compression costs and improved reliability. After system improvements, 8 microturbines were able to run simultaneously and monthly power generation increased from 144,000 kWh to approximately 230,000 kWh. From 2005 to 2014, total microturbine maintenance costs were roughly $715,000. Maintenance contract costs primarily involved preventative measures to keep the turbine inlet filters clean and periodic corrective maintenance for the turbine engines and control system. The microturbines are operational for 95% of the year and down for only 5%. Since going online, nearly $70,000 in improvements have kept the system running efficiently.



Microturbine Generator Absorption Chiller System
ILLUSTRATION COURTESY OF EMWD

Project Economics

Prior to installing CHP, building energy consumption was roughly 3.3 million kWh/year at a rate of $0.17/kWh, costing EMWD $560,000 annually. After the CHP system was installed and peak demand was offset, purchased energy dropped to about 2.6 million kWh annually, and the effective annualized rate for purchased power plus displaced grid power decreased to $0.09/kWh. The initial annual savings realized from the CHP installation were approximately $300,000, meeting the objective of a payback period of four years. After the first four years of operation, several system modifications were made that enhanced turbine reliability. This coupled with by higher energy costs that had increased to $0.25/kWh in peak summer months and improved annual energy savings to $504,000 per year.

Lessons to Share

Due to the complexity of the system, diligent operation and maintenance are required. The operational issues affecting the system include the loss of turbine efficiency in the summer due to high ambient temperatures; system control and integration issues; and inadequate water treatment for the cooling tower. The turbine engines had problems early on and were replaced by Capstone under warranty at no cost to the district. After 10 years in operation, new turbine engines are being installed in three of the eight microturbines, at a cost of approximately $200,000. Considering the maintenance, equipment replacement and other improvement costs, EWMD is still realizing significant benefits from the operation of the CHP system.

For More Information

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