MIDWEST

U.S. DOE

CHP Technical Assistance Partnerships

PROJECT PROFILE

Caterpillar Aurora

15 MW CHP System

Project Overview

Caterpillar's Aurora, Illinois plant is a 350 acre site that houses their Wheel Loaders & Extraction Division. The plant has a maximum electrical demand of 16 MW and a maximum steam load of 200,000 lbs/hr. In August 2000, a turnkey combined heat and power (CHP) system was installed by Solar Turbines Inc., a subsidiary of Caterpillar, which included engineering, procurement, construction, project management and commissioning. Today, Solar Turbines continues to operate and maintain the CHP system. The main installation consists of two packaged Solar *Taurus*™ gas turbine generator sets and two Deltak heat recovery steam generators (HRSGs) for generating steam at 125 psig. The *Taurus* gas turbine generator sets are rated at 7.5 MW each, giving a total CHP system capacity of 15 MW. Each turbine is capable of producing 30,000 lbs/hr of steam without duct firing of HRSG. With duct firing, steam production can be increased up to 145,000 lbs/hr.

Quick Facts

LOCATION: Aurora, Illinois
MARKET SECTOR: Manufacturing
FACILITY SIZE: 4,200,000 sq. ft.
NUMBER OF WORKERS: ~2,700
CHP GENERATING CAPACITY: 15 Megawatts
PRIME MOVERS: Two Solar Taurus 70 turbines
INLET COOLING: Wetted-media evaporative cooling for preventing loss of capacity and efficiency during hot weather
FUEL: Natural Gas
HEAT RECOVERY EQUIPMENT:
(2) Deltak Heat Recovery Steam Generators (HRSGs)
HEAT RECOVERY RATE: Up to 290,000 lbs/hr
USE OF THERMAL ENERGY: Space & process heating
PAYBACK: ~4 Years
BEGAN OPERATION: August 2000

Reasons for CHP

The Aurora plant was an excellent candidate for CHP due to its large and coincident thermal and electrical loads. The project was financially attractive due to the imminent need to upgrade the plant's aging systems. The physical plant had old coal boilers with a baghouse and coal elevators. Significant expenses were needed ($6-9 million) to upgrade the coal boilers and related equipment. The existing equipment had obsolete parts and controls, and was generally inefficient and unreliable. Furthermore, the high emissions of NO_X, SO_X, CO_2, and CO from the coal plant were an environmental concern.

In addition to the aging physical plant, electricity deregulation in Illinois offered Caterpillar a choice – stay with the incumbent utility, switch to an alternative retail electric supplier, or generate some or all of its own power.

The Caterpillar Aurora Facility

If the plant switched to an alternative supplier, it would have been assessed a Customer Transition Charge (CTC) of up to 2 cents per kilowatt-hour by its utility to recover stranded costs. Self-generation, provided by the CHP system, was chosen because it avoided the higher cost of electricity, the CTC, as well as unplanned electric power outages.

Solar *Taurus*™ 70 Gas Turbine Generator Set

Benefits of CHP

The CHP project saved Caterpillar $2 million annually on energy costs for the first six years of operation; this number rose to $4.3 million in 2009. In addition, the new system avoids costs associated with unplanned outages. Along with the cost savings, the facility has realized many other benefits. The installed state-of-the art CHP technology provided higher overall efficiency and greater electrical reliability. The CHP system incorporated the latest air pollution controls, and remote monitoring and diagnostics. The CHP system greatly reduced the plant's environmental impact by emitting 47% less NO_X, 73% less SO_X, 72% less CO_2, and 37% less CO than the old coal system.

The CHP Plant Monitoring System

System Design and Operation

The CHP system was designed to centralize the supply of electricity, steam, and compressed air for the entire manufacturing facility. Combustion turbines are rated at an ambient temperature of 59°F, 60% relative humidity at sea level and in hot weather these machines see reduced power generation capacity, and decreased efficiency. In order to prevent the loss of power generation capacity and energy efficiency during hot weather, when power is needed most, Caterpillar decided to incorporate turbine inlet cooling (TIC). After considering the potential for power generation capacity enhancement, and the capital and operating costs of the various TIC technologies, such as wetted media, fogging and chiller system, Caterpillar implemented a wetted-media system as its preferred option. Additional equipment included:

- One 2-MW Caterpillar® reciprocating engine, for peak shaving and black start capability of the combustion turbine CHP system
- Three Enerflex gas compressors to compress incoming natural gas from the utility to the required pressure of the combustion turbines

Since the installation of their CHP system, Caterpillar has purchased the plant's supplemental power under a hybrid rate which has mostly fixed and some hourly pricing from a Retail Electric Supplier with ComEd's high voltage Retail Delivery Service. Both turbines are operated continuously from the end of November through the beginning of March. During the spring, summer, and fall, one of the turbines is shut down every other weekend on an alternating basis due to the plant's lower power and steam demands on the weekend.

For More Information

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