PROJECT PROFILE

Thermal Energy Corp. (TECO)

45 MW CHP System

Project Overview

In 2006, Thermal Energy Corp. (TECO), a 40 year old district energy company, started planning for meeting its growth and updating its system to maximize efficiency and reliability. Instead of expanding as a traditional plant, burning fuel for generating steam and buying electricity from the grid, it decided to install a new 45 MW combined heat and power (CHP) system in August 2010. It was part of an expansion of its District Energy (DE) system at the Texas Medical Center in Houston. The CHP system incorporates a 45 MW GE LM6000 PD Sprint aeroderivative gas turbine, 8,000 tons of electric centrifugal chillers and a 75,000 ton-hour chilled water (CHW) thermal energy storage (TES) tank.

The TES tank is charged with chilled water during off-peak periods, when demands for power and chilled water loads are low. The chilled water from the tank is used during peak cooling periods when electric costs are high.

Quick Facts

Location: Houston, TX

Electric Generation Capacity (ISO): 45 MW

Gas Turbine Model: GE LM6000 PD Sprint

Gas Turbine System: Cogeneration/CHP

TIC System Technology: Chillers and TES

EPC Contractor: Burns & McDonnell

TES Consultant: The Cool Solutions Company

TES Tank Supplier: CB&I

Chiller Supplier: Johnson Controls Inc.

In order to prevent a loss of electric power generation capacity and energy efficiency during hot weather, the gas turbine is cooled by using chilled water from the TES tank.

TECO is able to start and stop the gas turbine based on changing marketing conditions. When the gas turbine is operating, TECO can generate steam from the gas turbine exhaust gases, allowing them to burn less fuel in conventional boilers.

Due to the critical mission nature of TECO's customers within Texas Medical Center, the CHP system installation, along with its tie-ins, had to be implemented while the existing plant remained operational.

Reasons for CHP, TES and TIC

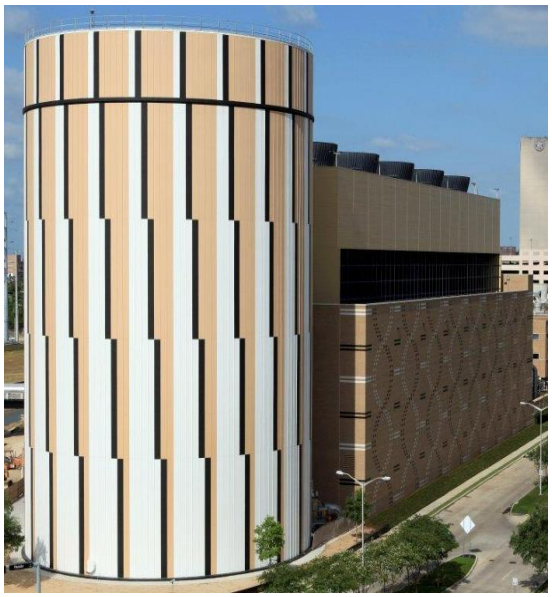
CHP is an excellent choice for TECO due to its large and coincident thermal and electrical loads, and also due to the high reliability and high energy efficiency of CHP systems. The TECO CHP system is able to operate at 78% energy efficiency, compared to about 33% average energy efficiency of utility electric power generation in the United States. TECO's CHP also helps reduce air pollutants by 302 tons of NOx, 305,000 tons of CO_2 and 83,000 metric tons of carbon per year. The project was financially

attractive due to the imminent need to upgrade the plants aging systems.

The TES tank helps reduce the plant's peak electric power demand and the otherwise necessary installed chiller capacity. The TES system in this plant won the 1st Place ASHRAE Technology Award in 2011.

Since all gas turbines lose power output capacity and energy efficiency during hot weather, turbine inlet cooling (TIC) helps prevent such losses, when power is needed the most and the cost of purchased electricity is highest.

"TECO is located in the hot and humid climate of Houston and we participate in the ERCOT marketplace with some very large price swings for electricity when the grid is at peak. Turbine Inlet cooling for our turbine has proven to be extremely valuable during both peak periods and in warm weather for the member institutions we serve. It allows us to maximize power production precisely when it is the most valuable," said Steve Swinson, TECO President and CEO.



System Design and Operation

All gas turbines are rated at the International Standards Organization (ISO) ambient conditions of 59°F temperature, 60% relative humidity, and sea level atmospheric pressure. In hot weather all gas turbines lose power generation capacity and efficiency. When ambient temperature increases to 100°F, power generation capacity of a GE LM6000 PD gas turbine drops from its 45 MW rated capacity at ISO to 37 MW, a nearly 18% loss. In addition to the reduction in generation capacity with this rise in temperature, energy efficiency of this gas turbine also decreases. In order to prevent this loss of capacity and efficiency, precisely when power demand and value are high, TECO decided to incorporate turbine inlet cooling (TIC). After evaluating the enhancement potential of various TIC technologies, including their capital and operating costs, TECO decided to use chilled water from a TES tank for TIC. The TIC system is designed to cool the inlet air from a 96°F condition.

Control Room

The new CHP system is designed to supply electricity, steam, and chilled water for the Texas Medical Center complex. The system supplies chilled water to 45 buildings and steam to 36 buildings.

For More Information

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