TURBINE INLET COOLING ASSOCIATION turbineinletcooling.org

PROJECT PROFILE

Electric Cooperative in Texas

240 MW

Project Overview

In 2006, an Electric Cooperative returned to service the reconstructed 240 MW gas turbine system at their north central Texas power plant. This 240 MW rated natural gas power plant supplies electric power to multiple co-ops and municipal systems as well as sells electric power into the spot market. The plant had been operating an evaporative cooling system for cooling the turbine inlet air to help prevent losses of generation capacity and energy efficiency during hot weather. The output of the plant with evaporative cooling decreased with increase in humidity. Therefore, in 2009, TAS Energy replaced the evaporative cooling system with a turbine inlet chilling (TIC) system including; water cooled chillers, a closed loop chilled water piping system, combustion inlet air cooling coils, and a thermal energy storage (TES) tank built by DN Tanks.

Quick Facts

Location: Cleburne, TX

Generation Capacity (ISO): 240 MW

Gas Turbine Model: Siemens SGT6-5000F

Gas Turbine System: 501F

Fuel: Natural Gas

TIC System Technology: Chillers and TES

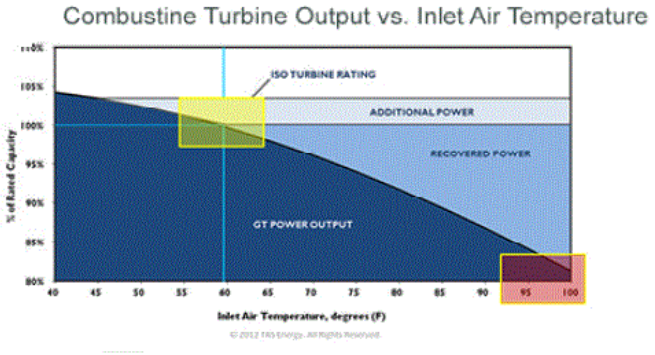
TIC System Supplier: TAS Energy

TES Tank Builder: DN Tanks

Chiller Supplier: Trane

Net Capacity Increase by TIC: 37.5MW (17%)

The new TIC system is designed to cool the gas turbine inlet air with electric driven water cooled chillers, and optimize the energy use with a 1.74 million gallon TES tank with a useable thermal storage capacity of 28,989 ton-hrs. The chillers are operated during off-peak periods, when power demand and chilled water demands are low, to produce chilled water for storage in the TES tank. The chilled water from this TES tank is used during peak cooling period.



Reasons for TIC, Chillers and TES

All gas turbines are rated at the ISO (International Standards Organization) ambient conditions of 59^{o}F dry-bulb temperature, 60% RH at sea level. All gas turbines start losing power out and energy efficiency as the

ambient temperature increases above 59^{O}F as shown the chart on the right side.

Since the electric power demand and electric energy price are high during hot weather in middle of the day, loss of power capacity and energy efficiency hurts the economics of the power supplier. Even with an evaporative cooling system, as the humidity increased, the effectiveness of this cooling system decreased. Therefore, the output of the gas turbine was reduced and varied with changing ambient humidity and dry-bulb temperature. The Electric Cooperative became interested in the turbine inlet chilling system with a TES tank so that they could provide almost constant output over a wide range of varying ambient conditions of temperature and humidity.

The use of a TES system allows the power plant to maximize the power output during on-peak period and also helps reduce the required chiller capacity and the related capital cost. Prior to the retrofit of the turbine inlet chilling system, when the ambient temperature was 95FDB/75FWB, the output of the power plant 227 MW. After the turbine inlet chilling system was installed, the power output of the turbine increased to 266 MW at the same ambient temperature conditions. After deducted the small parasitic load of the turbine inlet chilling system, the net power output of the plant was 37.5 MW.

System Design and Operation

Chillers Building and TES TANK

The power plant supplies electric power to multiple member co-ops and municipal systems as well as sells into the spot market.

In order to maximize the power output during on-peak period, when power demand and electric energy prices are high, no chillers are operated. This helps eliminate the chiller parasitic load. Only chilled water from the TES tank is used for TIC on-peak period. The chillers are operated during off-peak period to produce chilled water for storage in the TES tank.

For More Information

Turbine Inlet Cooling Association
427 Prairie Knoll Drive
Naperville, IL 60565
Phone: (630) 357-3960
Fax: (630) 357-1004
www.turbineinletcooling.org

Ver2015Dec1