AHTF® - Advanced Heat Transfer Fluid Solutions

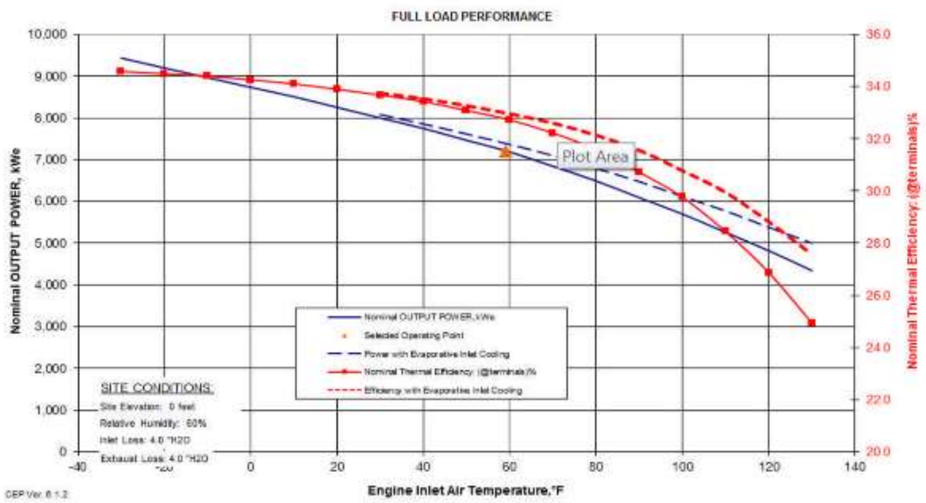
AHTF® and TIC (Turbine Inlet Chilling) Performance

Among the most efficient fossil fuel power plants are those that use natural gas, i.e. natural gas turbine plants. The average natural gas power plant efficiency in the US is under 50%. The power generation industry strives to make gas power plants operate more efficiently through the use of new technologies and the use of waste heat generated in the process of generating electricity.

One such technology that increases natural gas turbine power plant efficiency is Turbine Inlet Chilling (TIC). Turbine Inlet Chilling is most compelling in warm climates when power output from gas turbines decreases but demand is highest because of air-conditioning requirements. Gas turbine power plants are generally designed to produce rated output at 60° Fahrenheit and operate more efficiently when the ambient (inlet) temperature is low. Lower inlet air temperatures significantly increase power production and improve power plant efficiency during periods of warm weather.

TIC can increase the plant efficiency by up to 35%. Generally, cooling the inlet air entering the compressor by 40 - 50°F will result in about a 15 - 20% increase in power output.

Figure 3-5. Effect of Ambient Temperature on Capacity and Efficiency

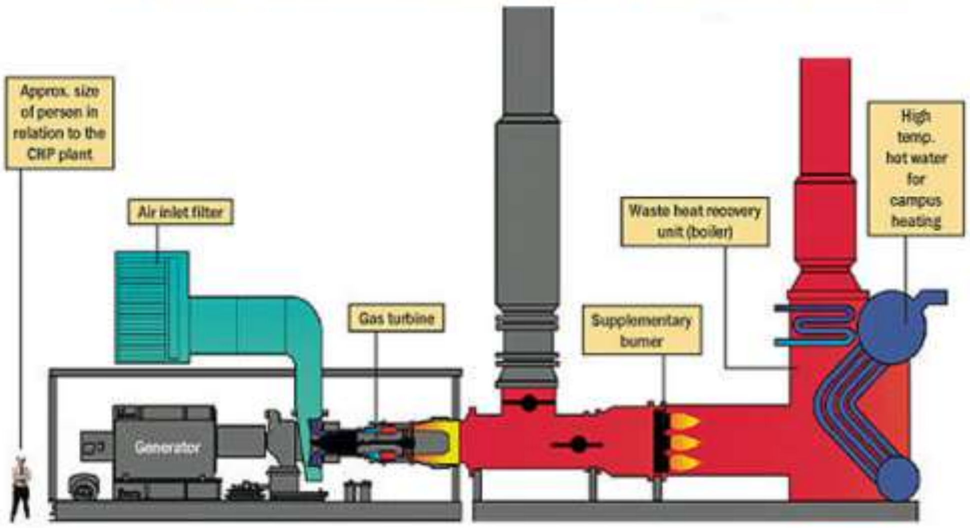


Source: Solar Turbines, Taurus 70[52]

How Does TIC Help Increase CT Output?

Power output of a combustion turbine (CT) is directly proportional to and limited by the mass flow rate of compressed air available to it from the air compressor that provides high-pressure air to the combustion chamber of the CT system. An air compressor has a fixed capacity for handling a volumetric flow rate of air for a given rotational speed of the compressor.

Figure 3-1. Gas Turbine Configuration with Heat Recovery



Source: University of Calgary

Even though the volumetric capacity of a compressor is fixed, the mass flow rate of air it delivers to the CT changes with fluctuations in ambient air temperature. This mass flow rate of air decreases with an increase in ambient temperature because the air density decreases when air temperature increases. Therefore, the power output of a combustion turbine decreases below its rated capacity at the ISO conditions (59°F and 14.7 psia at sea level) with increases in ambient temperature above 59°F. TIC allows an increase in air density by lowering the temperature, and thus, helps increase the mass flow rate of air to the CT. This results in increased output of the CT.

How AHTF® can improve TIC performance?

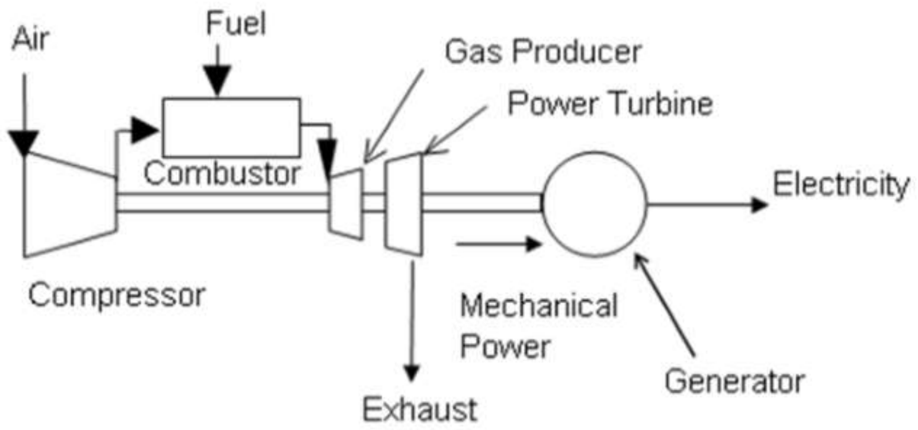
Some TIC systems utilize electric chillers (or absorption chillers without any parasitic loss) and circulate that chilled water through coils located at the inlet of the turbine. The energy consumed by the electric chiller, usually about 0.65 kw/ton, is a parasitic load. And, in certain climates glycol must be added to the water which increases this parasitic load to 0.85 kw/ton or higher.

AHTF® is a technology that dramatically increases convective heat transfer.

AHTF® will reduce heat exchanger approach temperature thereby making the TIC process more efficient, boosting CT power and reducing parasitic load. Third party M&V has shown that AHTF® reduced approach temperatures (ΔT) on energy recovery coils from 8.5 deg.f. to 1.1 deg.f.

In addition, where "free cooling" coils or chiller economizers are used, there is a dramatic increase in the number of free cooling hours. This further increases plant performance by using AHTF®.

Figure 3-2. Components of Simple Cycle Gas Turbine



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