With rising energy costs and shortages around the world, the power industry continues to seek innovative solutions to these problems. The demand for energy worldwide continues to rise faster than generating capacity, and the deregulation of the electric power industry has created demand for products that will make power producers more efficient.

Modern gas turbine technology has made enormous progress toward the related goals of increasing plant capacity and improving efficiency, but even these modern plant designs may suffer heat losses unless proper cooling techniques are implemented.

The Hunts Bay Power Station is a 668-megawatt (MW) combined-cycle cogeneration power plant located in Kingston, Jamaica. The plant is owned by Jamaica Public Service Company Ltd.

The Hunts Bay facility includes three combustion turbines; two GT Browns and one GE Frame 7. They needed to improve plant operations and increase output and efficiency in order to recover power and generate greater revenue.

In addition, nitrous oxides and carbon monoxide emissions must be continuously monitored and controlled at the facility with minimal environmental impact.

Increasing Demand
The average annual growth in demand for electricity in Jamaica over the past 10 years was approximately 5 percent and the forecast for the next five years is 6 percent annum.

Based on our current installed capacity of 668 Megawatts (MW), it is expected that demand surpassed our generating capacity,” said Dave Stamp, Facility Engineer for Hunts Bay Power Station.

It was with this in mind that Jamaica Public Service Company Ltd. investigated ways to economically increase the capacity of its generating units. One such method utilizes evaporative cooling technology to cool the inlet air to the gas turbine.
The Munters Solution

Because large amounts of air are required to operate gas turbines, the power output and fuel consumption of a gas turbine generator are highly dependent upon mass flow, quality and ambient temperature of the air drawn into the combustion chamber.

"The cleaner and cooler the air taken into the turbine is, the more efficient the turbine operates," said Stamp. "Conversely, as the air inlet temperature rises, power output falls and efficiency decreases."

In order to prove the suitability of the inlet air cooling technology to the Jamaican climatic conditions, a pilot project was conceived. Gas Turbine no. 4, a John Brown Engineering MS5001 (Frame 5) unit with an ISO rating of 25.5 MW [59°F and 14.7 pounds per square inch absolute (psia) inlet air] and a site rating of 21.750 MW [88°F and 14.7 psia], was selected.

"We became aware of inlet air cooling as an option after noticing a Munters advertisement on the subject," said Stamp. "We would later contact them for an economic analysis."

According to Stamp, there were several reasons Hunts Bay chose to use an evaporative cooling system at the plant versus other cooling methods.

"We chose evaporative cooling because of its ease of retrofit installation, low operating cost and low inlet pressure drop," said Stamp. "In addition, it was economically the right choice for us and the unit was also easy to install."

Munters TURBidek system provided cooling to inlet air during the pilot test resulting in future permanent installations. Climatic conditions in Jamaica were ideal for installing evaporative cooling.

"A gradual reduction in capacity is expected with increased ambient temperature, hence in Kingston, with high ambient temperatures of 90-92°F in the summer months, only approximately 85% of ISO MCR can be realized," said Stamp. The pilot test was conducted for six months, from January through June 2000. The results of the test proved that Hunts Bay Power Station benefited from the installation of the Munters evaporative cooling system.

"We regained as much as 10% of our power capacity with the addition of the evaporative cooling unit," said Stamp.

"While power companies in southern countries realize the impact evaporative cooling can have on turbine performance, we are also seeing opportunities developing as far north as Toronto," said Larry Klekar, sales manager for Munters Systems Division. "Inlet cooling returns the investment so rapidly that installations are a good decision throughout most of North and South America."

"Cooling the combustion air for a gas turbine plant is a smart way of getting more power," said Klekar. "With Munters Evaporative Cooling System and an ambient dry bulb temperature of 95°F, it's possible to recover as much as 15% of the lost power just by cooling the intake air. Stamp noted, "We are extremely pleased with the performance of the Munters evaporative cooling units and we plan to install more units on our turbines in the near future."