Case study: Air Treatment
Hunts Bay Power Station
Kingston, Jamaica

BENEFITS

- Improves efficiency and 10+% power output augmentation
- Regains capacity during periods of high ambient temperature
- Low cost option for power optimization
- Reduces pressure drop

# Evaporative Cooling Increases Gas Turbine Power Output

## Challenges Facing the Power Generation Industry

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.

Munters Corporation, Air Treatment Division
Phone +1 800 843 5360 / E-mail dhinfo@munters.com / munters.com

Munters

Installation of a Munters TURBIdek evaporative cooling system increased power output by 2.4 MW.

## 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, resulting in a higher power output," 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 climates 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."

### Facts

Installing Munters TURBIdek evaporative cooling systems enabled Hunts Bay Power Station to:

- **Increase Power Output**
  The maximum load achieved during the test was 24.6 MW at 88°F. This represents an increase of 2.4 MW.
- **Reduce Pressure Drop**
  The old inlet filters were removed and replaced with the evaporative cooler, which resulted in a much lower pressure drop. The air encounters less pressure drop on the way into the combustion turbine (CT) compressor, improving mass flow and yielding higher efficiency and power output.
- **Reduce Heat**
  An average reduction in heat rate of 1.6% with annual savings of $40,857.00.
- **Reduce Maintenance**
  The evaporative cooling system is low in maintenance. "Installation of the Munters system has proved to be a cost-effective, low-maintenance way to increase output levels and improve thermal efficiency," Stamp noted.

Australia Phone +61 2 8843 1580, serviceairt@munters.com.au Austria Phone +43 1 6164298-0, service.dh@munters.at Belgium & Luxemburg Phone +32 2 240 6868, service.dh@muntersnv.be Brazil Phone +55 41 3317 5050, munters@com.br Canada Phone +1 905 858 5894, dhinfo@munters.com China Phone +86 10 8041 8000, serviceairt@munters.cn Czech Republic Phone +420 544 211 434, servicecz@munters.de Denmark Phone +45 4495 3355, service.dh@munters.dk Finland Phone +358 40 186 3074, service.dh@munters.fi France Phone +33 1 3411 5757, service.dh@munters.fr Germany Phone +49 40 87 96 90-0, service.dh@munters.de India Phone +91 20 6681 8900, serviceairt@munters.in Italy Phone +39 0183 521 377, service.dh@munters.it Japan Phone +91 3 5970 0021,serviceairt@munters.jp Korea +82 2 761 8701, serviceairt@munters.co.kr Mexico Phone +52 722 270 4029, servicedhmx@munters.com Netherlands Phone +31 172 43 32 31, service@munters.nl Poland Phone +48 58 305 35 17, service.dh@munters.pl Singapore Phone +65 6744 6828, serviceairt@munters.com.sg South Africa Phone +27 11 971 9700, info@munters.co.za Spain & Portugal Phone +34 91 640 09 02, service.dh@munters.es Sweden & Norway Phone +46 8 626 6300, service.dh@munters.se Switzerland Phone +41 52 3438886, service.dh@munters.ch Thailand Phone +66 2 6422 6703, serviceairt@munters.com.sg Turkey Phone +90 216 548 1444, serviceairt@munters.com.tr UAE +971 4881 3026, middle.east@munters.com United Kingdom & Ireland Phone +44 1480 432243, service.dh@munters.co.uk USA Phone +1 800 843 5360, dhinfo@munters.com Vietnam Phone +84 8 3825 6838, vietnam@muntersasia.com

Munters

**Munters Corporation**
Tel: (800) 843-5360 E-mail: dhinfo@munters.com
www.munters.com

CS0080 09/16