MeeFog™ Wet Compression Boosts Power Output by Almost 10% at Mexico Plant

**MeeFog™ System Applications**
- RO WATER TREATMENT
- GAS TURBINE COOLING
- Power Generation
- Oil, Gas, Petrochemical
- Offshore Operations
- Humidification
  - Commercial HVAC
  - Manufacturing
- Evaporative Cooling
  - Data Center Cooling
  - Condenser Cooling
  - Heat Exchanger Cooling
- Special Effects
  - Amusement Parks
  - Themed Entertainment
  - Zoos, Aquariums, Gardens
  - Tourism Art
  - Private Residence
- Agriculture/Other
  - Greenhouses
  - Conservatory
  - Wine Barrel Storage
  - Cold Storage
  - Dust Suppression
  - Odor Control
  - Cement Cooling

**About Mee Industries Inc.**
For over 45 years Mee Industries has led the world with innovative water fog technology. MeeFog systems are used to humidify and cool many industrial, commercial and agricultural processes and to create interesting and dynamic special effects. Today there are over ten thousand MeeFog systems in use around the world. The MeeFog team looks forward to helping you with your fogging project.

**The Mee Advantage: Experience, Innovation, Performance**
In 1969, Thomas Mee Jr. a former Cornell University research scientist, founded Mee Industries. The company originally manufactured high-tech electro-optical, meteorological instrumentation, but by the early 1980’s, high-pressure water fogging had become the main focus of the company. Today, Mee Industries provides innovative, highly effective, economical fog solutions for many industrial applications including gas turbine inlet-air fogging, commercial and industrial building humidification and cooling, data center humidification, outdoor air conditioning, greenhouse climate control, wine barrel storage humidification, as well as dynamic special effects for the entertainment industry and theme parks.

**Industry Leaders — Focused on Fog Technology**
Mee specializes in providing custom-engineered, turn-key high-pressure fog solutions. We are committed to researching, developing, marketing and supporting the most innovative and reliable fog systems available anywhere in the world.

**Norte Durango Power Plant Durango**
Global Power Generation (GPG), a subsidiary of Gas Natural Fenosa, the second largest private power producer in Mexico, operates this combined cycle power plant. The 450 MW Norte Durango power plant is located in the state of Durango in the north-west of Mexico, at an altitude of 6,076 feet (1,852 meters) above sea level.
Details of the Wet Compressions Fog System

The Durango combined cycle plant was built with media type evaporative coolers. An array of fog nozzles was installed downstream of the evaporative coolers to provide wet compression spray to the gas turbine compressors.

The existing evaporative coolers are only about 85% effective so the MeeFog systems are designed to provide evaporative cooling to 100% relative humidity plus a wet compression spray of up to one percent of the GT mass flow.

The fog system is designed to add fog in eleven equal stages, which makes it possible to dial in the amount of power boost desired in increments of 1.27 MW.

Each of the fog skids have five high-pressure pumps. A total of 858 MeeFog impaction-pin nozzles are installed in the inlet ducts of each of two turbines. These precision-engineered nozzles have an orifice of 0.008" (200 microns).

The nozzles produce a spray with 90% of the water mass flow being in droplets that are 19 microns or smaller.

The operating pressure of the fog system is 2,000 psig (138 bar) and each nozzle has a flow rate of 0.08 gpm (0.30 lpm). The maximum water flow is 68.6 gpm (260 lpm).

The air-pressure drop through the nozzle array is negligible and the power consumed by the fog pump skid is just 82.1 kW, which is less than 1% of the power boost.

The Installation

The Norte Durango Power Plant began commercial operation in August of 2010. It comprises two gas turbines and one steam turbine. Construction began in January 2008 for what was one of the largest power projects ever undertaken in the state. Given the scale of the project, the Chávez Compression Station was expanded to supply gas at the pressure required by the turbines undertaken in the state. The plant was awarded the Clean Industry Certification granted by Mexico’s Federal Attorney for Environmental Protection (PROFEPA).

This combined cycle power plant is operated by GPG. To increase output and efficiency, and lower emissions, GPG engaged in a series of upgrades, including the modification of the afterburner system as well as the addition of the MeeFog wet compression systems.

The afterburner upgrade produces a power boost of 16 MW. Modifications to the afterburner system were carried out to increase its usage rate and effectiveness. This was done within the design limits of the heat recovery boilers.

Adding MeeFog systems to the two Siemens SG76-500F gas turbines produced an even greater increase in capacity. Mee Industries’ representative in Mexico, GARPE, S.A. de C.V., facilitated the wet compression project. The project was given the green light because it was determined that 12.6 MW of power augmentation per unit could be achieved.

“The MeeFog installation raised the power generated by each gas turbine by 14 MW for a total of 28 MW for the Norte Durango combined cycle plant,” said Rafael Garcia, technical consultant for GARPE, S.A. de C.V. of Mexico.

That’s an additional power gain of 8.8% from wet compression, over and above the gain from existing evaporative coolers present in each turbine.
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**CHALLENGE**
The Mexico plant needed to find a cost-effective way to increase power generation.

**SOLUTION**
Two Siemens SGT6-5000F gas turbines were fitted with MeeFog wet compression systems. This raised the output of each turbine from 157 MW to 171 MW for a total power boost of 28 MW. The fog systems cost much less than chillers or other power augmentation systems and far less than adding new turbomachinery.

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