MeeFog™ Provides More Megawatts for a Southern California Oil Refinery

THE BENEFITS OF MEEFOG™ TECHNOLOGY

- Boost gas turbine output by cooling the inlet air
- Minimal maintenance required
- Easy retrofit and rapid installation

CHALLENGE

It’s been over three decades since the last major oil refinery opened in the United States. Since then, the number of refineries has dropped by half, so to meet growing demand for fuel, existing refineries have added capacity. But with ever-tightening emissions regulations any such expansion is closely scrutinized, and refineries must continually find ways to lower their energy usage and reduce their environmental impact.

Oil Refinery in Southern California
Los Angeles Area

SETTING UP COGEN

A major refinery in the Los Angeles area had been using a gas turbine to convert its refinery gas to electricity, but increased demand due to plant expansion exceeded the generator’s output on hot days.

The refinery dates back to the California oil rush days of the early 1900s. Over the years, the refinery continued to grow and now has a capacity in excess of 130,000 barrels per day. It consists of two primary locations located about five miles apart. One facility acts as the front-end of the refinery, receiving domestic crude via pipeline and foreign and domestic crude via tankers unloading at LA/Long Beach port.
The other plant does the final refining and blending of the finished gasoline, diesel and jet fuels destined for the California, Arizona and Nevada markets.

In the 1980s, in order to reduce their emissions, all LA area refineries needed to start replacing their boilers. In 1988, this particular refinery built a cogen plant to burn refinery and natural gas. At that time, the refinery needed 42 MW. It installed a Siemens Wetinghouse CW 251B-10 turbine which had a 44 MW capacity and was able to sell the extra capacity to the Los Angeles Water and Power.

“We were doing well for many years,” says the project manager. “But the refinery kept expanding, kept adding production units, and our MW kept getting tighter and eventually ran short.”

So in the mid-90s, they upgraded to a CW 251B-12 turbine, which gave them 50 MW nominal output. A Heat Recovery Steam Generator (HRSG) supplies the refinery with more than 200,000 lbs. of steam per hour.

“This kept the power generation and refinery demand in approximate balance,” he continues. “But during the hot days, as is typical with any gas turbine, the heat makes the air less dense and the output drops by as much as 5MW.”

“During the performance tests, we dropped from 100 degrees to 70 degrees F at the inlet. We gained 5MW which brought us back up to the nominal rating.”

— Project Manager
Learning from Neighbors

This refinery is far from being the only distributed generation facility in that neighborhood. For example, there is the Harbor Cogen facility on Pier B Street in Wilmington with a GE Frame 7 that went into operation in 1988, the same year as the refinery’s initial 251B-10. There is also a refinery in Carson, and the Watson Cogeneration Plant next to the refinery which has four GE Frame 7EAs. Both of these used MeeFog inlet cooling to boost their power and the project manager kept up on their progress.

Recovering Lost Power

While the refinery’s mid-90s upgrade was adequate for a number of years, eventually it did need to boost its generation on hot days. At that point, however, the company didn’t need to launch into a research project to determine what was best.

“I am aware of all the cooling technologies and have evaluated all those for more than ten years,” says the project manager. “I knew on the spot that fogging was the least cost, and most effective way to go.”

He says that the company picked Mee to provide the system because it has the most applications around the world and the most proven technology.

“You have to make absolutely sure your air flow path from the fog system going down to the GT inlet must be super clean and free of rust or any particles that can get washed off from the walls or silencers,” he says.

The MeeFog system was installed in October 2011. An array with 429 fogging nozzles was installed just downstream of the air filter. The system has 11 operating stages providing up to 30 degrees of cooling, so the inlet temperature can be controlled within a few degrees.

“During the performance tests, we dropped from 100 degrees to 70 degrees F at the inlet,” the project manager says. “We gained 5 MW which brought us back up to the nominal rating.”

He has the automatic control system set to operate whenever the temperature is above 50 degrees. He says maintenance on the system is minimal, just changing the pump oil on schedule and checking during the annual turnaround to see if any of the nozzles are plugged.

“If you need extra power, I recommend fogging as an option,” he says. “It is the cheapest and fastest way to get power.”
### WATER AND POWER REQUIREMENTS

<table>
<thead>
<tr>
<th>GAS TURBINE MODEL</th>
<th>ISO OUTPUT (kW)</th>
<th>kW 100°F (38°C)</th>
<th>WATER FOG FLOW</th>
<th>kW 80°F (27°C) SATURATION</th>
<th>POWER INCREASE (kW)</th>
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Table showing water consumption for 11°C (20°F) of inlet cooling and gas turbine power increases attainable. Actual numbers are site specific. Mee Industries can provide a detailed analysis for your application.

### 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.

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**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
  - Fountain Art
  - Private Residence
- **AGRICULTURE/OTHER**
  - Greenhouses
  - Conservatory
  - Wine Barrel Storage
  - Cold Storage
  - Dust Suppression
  - Odor Control
  - Cement Curing

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**HEADQUARTERS**

Mee Industries, Inc.
16021 Adelante Street
Irwindale, CA 91702
T: 626.359.4550
F: 626.359.4660
www.meefog.com

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