BY MARK MCNEELY

Engine Cleaning Technology (ECT) has developed a two-step system for gas turbine power augmentation, which consists of both evaporative cooling coupled with mass flow augmentation. Pictured is the company's mass flow nozzle.

Two-step Program for Gas Turbine Power Augmentation

If you want to get into a debate in the gas turbine industry, just tell someone which gas turbine inlet air cooling scheme is better and above all of the others. Nowhere else on the gas turbine landscape are you able to generate such passionate responses to divergent technologies. All of the inlet air cooling techniques have certain merits, which can leave gas turbine operators with decisions to make. In a somewhat conservative environment, these operators are likely to stay with what has worked in the past, regardless of someone's impassioned pleas to the contrary.

So when a company specializing in evaporative cooling (or fogging) and mass flow augmentation (or power augmentation) does innovate, it is also worthy to take notice. Such is the case with Engine Cleaning Technology Inc., (ECT) and its patented "two-stage" inlet air cooling arrangement designed for gas turbine power augmentation.

"ECT's patented process focuses on separating the fluid flows for inlet cooling and mass flow augmentation," explained Bruce Tassone of ECT. "By utilizing two injection locations, we can maximize the efficiency of the fog cooling, control the droplet size by minimizing agglomeration, and reduce the potential for secondary wetting in the inlet. Then by moving the power augmentation manifold closer to the compressor inlet, the droplets and flow can be sized to allow for maximum flow rates in conjunction with an upper limit on drop size.

"Additionally, ECT uses a custom fog nozzle that eliminates the impingement pin. This configuration avoids all the problems associated with the impingement pin nozzles such as spray pattern degradation, droplet size increase, pin breakage, etc." Tassone added.

ECT's fog nozzle also contains an anti-drip check valve. The water filtration is performed at the pump, thus eliminating individual nozzle filters. These nozzles can be integrated into existing nozzle grids for refurbishment and retrofits.

Fogging benefits are highest in low-humidity climates, according to Tassone. "Where partial loads and peak duty are seen, power augmentation is ideal as the up-front installation cost is minimized and the output gains are achieved regardless of the ambient condition. It is important to note that in all cases, the effects of fogging and power augmentation are cumulative."

Power augmentation is approximately a linear function of mass flow in this range. Typically for each 1% increase in mass flow through the introduction of water, a 6% increase in output is achieved. This has been a consistent value with the applications ECT has installed to date, Tassone said.

For each of ECT's installations, customization occurs to ensure the fogging matrix is installed to permit full evaporation of the fluid prior to it reaching the compressor inlet. Mass flow augmentation nozzles must be customized to meet the necessary airflow rates and accommodate the installation of the nozzle onto the compressor inlet. As each inlet and site-specific requirements vary, engineering support aids the customer to ensure a timely and smooth installation process.

Also, since ECT designs additional fluid injection schemes like online and crank washing systems, fogging skids, power augmentation skids and NO_x skids, these functionalities can be assembled using a single skid and control arrangement. "Combining these capabilities onto a single skid lowers the initial cost to the customer and simplifies the skid management tasks. In all cases, the site requirements for electrical, control integration, explosion proofing, T&D capacity, etc., should be reviewed as standard engineering protocol for a successful installation," Tassone said.

As part of a routine maintenance program, the differential pressure gauges and flow meters should be checked every 500 operating hours, according to Tassone. "We recommend the spray

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Along with power augmentation, ECT also provides products for online and offline gas turbine compressor cleaning, such as this skid featuring a combination of online cleaning and power augmentation capabilities.

patterns be checked twice yearly if possible and once yearly if under base load conditions. The full nozzle assemblies should be inspected during scheduled outages for cracks, loose connections, etc., as part of the standard gas turbine maintenance practices."

Tassone also indicated that ECT has received no complaints from its customers showing any adverse effects on turbine component life by using a combination of evaporative cooling and mass flow augmentation. "In normal applications, the inlet assembly and compressor should be inspected during routine maintenance to ensure the components have not incurred any erosion or corrosion effects."

With regard to lowering gas turbine exhaust emissions, NO_x emissions tend to lower during the injection of water either by fogging or power augmentation. "As the compressor temperatures are lowered, there is a reduction in the NO_x levels. However, these fluid injection technologies are not specifically designed to achieve lower emission, but rather to improve gas turbine performance," Tassone said.

All of ECT's technologies are designed to ensure safe and dependable results. The online, crank wash and mass flow augmentation equipment are all engineered for ease of installation and maintenance, minimize vibration and extend life. The various liquid injection technologies offered by ECT can be combined onto a single skid as a turnkey package. This lowers the upfront purchase and installation costs. Customers can also select discrete functionalities using ECT's modular technology for future expansion.

Customers also have the option to purchase component subassemblies. This allows the end user the advantage of assembling their own new package or upgrading existing equipment. "These technologies can be combined with existing hardware. This allows the plant to effectively upgrade their existing equipment without a complete rebuild. In one case study, by replacing the fog nozzle tips, ECT was able to lower the operating pressure of the fog skid, lower the pump failure rate and still achieve maximum fog inlet cooling," said Tassone.

ECT designs and manufactures specialty chemicals and cleaners to improve the performance of turbomachinery and internal combustion engines. "We offer custom nozzle assemblies along with specialty pump skids to accommodate a wide variety of flow rates, pressures, liquid media and site-specific requirements. ECT's — and their affiliate's — equipment is placed in gas turbine, diesel and centrifugal flow compressor applications worldwide."

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POWER SYSTEMS LITERATURE

INDUSTRIAL ENGINE CONTROLS

Information regarding its monitors for industrial stationary applications has been made available by FW Murphy. The brochure provides photos of products available within the power unit line, as well as information covering the ability of the controllers to be compatible for both mechanical and electronic engines.

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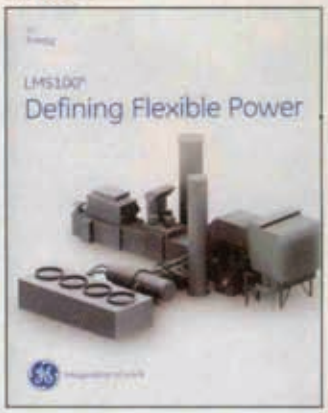
GAS TURBINES



Literature about the LMS100 gas turbine has been made available by GE Energy. This literature includes graphs showing flexibility of the turbine, as well as photos of each part. The ISO base rating ranges from 97 to 112 MW at speeds of 3000 and 3600 r/min.

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