A clean way to use liquid fuels

THE LPP SYSTEM GASIFIES LIQUID FUEL, BUT INERTS IT TO MAINTAIN EMISSIONS

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Given the price and supply volatility of natural gas, many gas turbine operators crave greater flexibility in terms of using less expensive fuel alternatives. However, gas turbines that are tuned for natural gas are often unable to handle liquid fuels — which can create combustion instabilities, and increase the risk of autoignition, flashback, and increased NO_X and CO emissions — without extensive system tuning or hardware modification.

To provide gas turbine operators with greater fuel flexibility, LPP Combustion LLC (Columbia, Md.), an associate of Combustion Science & Engineering, Inc. (CSE; Columbia, MD), has developed a standalone, skid-mounted system that first vaporizes and then conditions a range of liquid fuels as varied as methanol, ethanol, diesel, coal-derived liquid transportation fuels, naphtha, No. 2 fuel oil and kerosene, so their combustion properties, emissions (Figure), heating values, and autoignition characteristics are more closely aligned with those of natural gas.

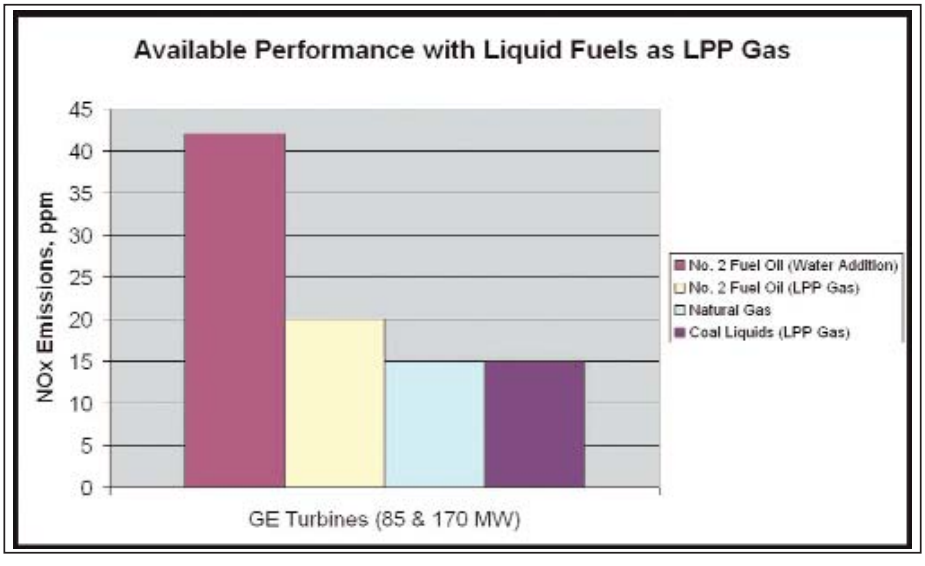

Figure: When liquid fuels (in this case No. 2 fuel oil and coal-derived transportation fuels) are treated using the LPP process and then burned in a lean premix mode (using a DLN combustion system), the resulting emissions are comparable to that produced using natural gas

Using inert gases

The fuel produced by the CSE system — dubbed LPP Gas — can be used as a direct substitute for natural gas "with no modifications to the existing combustor hardware," says John Sams, LPP president and COO. Depending on the fuel and the turbine, the system has the flexibility to control the combustion heating value of the conditioned fuel (so it equals that of natural gas) on either a mass basis or a volumetric basis, say the developers.

When equipped with LPP's new system, a gas turbine is started up using natural gas, and over the course of just a few minutes, the fuel is gradually transitioned through a range of intermediate compositions, from 100% natural gas to 100% LPP Gas, with no shutdown, says Mike Klassen, principal research engineer for CSE. The LPP Gas skid vaporizes the liquid fuels into an inerting gas stream ahead of the turbine combustion system, thereby eliminating the risk of autoignition or elevated emissions levels, adds Rick Roby, a managing member of LPP.

Meanwhile, the LPP gas stream has the added benefit of providing some power augmentation to the turbine (enough to offset the parasitic losses associated with operating the skid), due to the higher mass flow rate of the LPP Gas that is produced in the presence of the inerting gas.

According to the company, the prefabricated LPP Gas system is appropriate for use with today's Dry Low NO_X (DLN) combustors that need natural gas for their optimal operation. Because the characteristics of the LPP Gas are so close to those of natural gas, they "provide comparable NO_X and CO emissions when burned in existing DLN combustion hardware," says Leo Eskin, CSE's director of advanced energy systems.

The company is in the process of constructing its first demonstration-scale unit — a skid-mounted LPP Gas System that will be retrofitted to an industrial 1.5 MW Kawasaki turbine (whose combustor is similar to that of larger DLN technology that is widely used in power generation) that is part of a cogeneration facility at a chemical plant. LPP expects to have at least two commercial-scale contracts by 2007.

LPP Combustion has not selected a turbine OEM to partner with. Instead, it is focusing on the retrofit market to give more options to existing turbines. TI