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Ansaldo Energia expands industry knowledge on burning of alternative fuels in gas turbines

There are relatively few companies worldwide with the technology and experience to modify existing gas turbines (GTs)—or build new engines—to burn alternative gaseous and liquid fuels. Italy's Ansaldo Energia is one of these. The company's work focuses on opportunity fuels such as off-gases from steel and other processes, naphtha, high-hydrogen-content gases from natural-gas reforming activities, and low-Btu gases produced from tar, coal, coke, and biomass.

Ansaldo engineers favor the V94.2 engine when alternative fuels are available. Since its introduction to the energy industry in 1981, more than 230 V94.2s have been installed worldwide. The use of alternative fuels has increased dramatically in the last 10 years or so, say F Bonzani and R Gatti, two of the company's combustion-system experts. In areas lacking natural-gas infrastructure that also are experiencing rapid growth in electrical demand, they continue, alternative fuels are of strategic importance.

Bonzani and Gatti, and colleague P Gobbo, discussed the company's combustion development work, as well as commercial successes, at the recent Power-Gen Asia conference sponsored by PennWell Corp, Tulsa. All three engineers collaborated on "Benefits from the Operating Experience Achieved in IGCC Heavy-Duty Gas Turbine," which updated a paper presented only a couple of months earlier at Power-Gen Europe and was profiled in the Business Partners section of the COMBINED CYCLE Journal's 2Q/2006 issue.

Bonzani and Gatti reviewed, in particular, operating experience with low-methane-content gas in Pakistan and with naphtha in India. Their paper, "Ansaldo Energia V94.2 Gas Turbine: A Reliable Engine for Many Types of Fuels," and the one noted in the paragraph above, are available through the Journal's editorial offices. For your copy, write Bob Schwieger at bob@psimedia.info.

Pakistan. Operating experience with the poor Pakistani fuel at the 225-MW Liberty Power Plant, which dates back to early 1999, has been excellent. Composition of the gas is 80% to 82% methane, up to 2% hydrogen, 4% to 5% carbon dioxide, 8% to 11% nitrogen, and the remainder consisting of various percentages of C_2, C_3, and C_4 fractions. Heating value is about 30% lower than pipeline-quality gas typically burned in North America and Europe.

The low-quality Pakistani gas burns without any problem, say the authors, using the standard V94.2 burner designed for methane operation—provided fuel-gas pressure is adequate and the engine is tuned for the service. Ansaldo's experts add that low-quality fuel must be delivered to the engine at slightly higher pressure than methane for good results.

This particular engine is operated in both diffusion and premix modes according to the load range, as it would be if the fuel were methane. The low heating value has had no negative impact whatsoever on either mode of operation or on the transfer procedure and transient phase in going from diffusion to premix and vice-versa.

The gas for Liberty comes from several wells and its composition can vary over time and with production quantities from individual wells. As noted above, hydrogen content can range from 0% to 2% and ethane from 0% to 1.2%. Combustion experts know that, in theory, the higher the fraction of heavy hydrocarbons and/or hydrogen, the greater the risk of disturbed combustion. At Liberty, however, there have been no indications of unstable combustion, nor have there been any flashbacks, not even when the fuel-gas composition has gone from the lower to upper limits of these constituents and vice-versa. Operational experience extends over 75,000 hours.

India. The 220-MW combined-cycle Samalkot Power Station in Andhra Pradesh state, which began operating in early 2001, was commissioned on natural gas. The units also were designed to operate on naphtha and light fuel oil, and on a combination of those fuels. Note that in India, distillate often is referred to as HSD because it meets the country's fuel specifications for high-speed diesels.

Problems with the naphtha supply chain precluded use of that fuel until mid 2003 when a test burns were conducted for both it and HSD. Of greatest concern to engineers was flame stability of naphtha and its combustion behavior because of the fuel's high volatility. They watched closely for any negative effects of humming phenomena during test runs.

Special humming detectors were installed along with sensitive bearing vibration pickups. Tests across the entire load range on naphtha showed humming effects were completely negligible below 90 MW and never significant above that operating point. Bearing vibration levels also were very low. CCJ

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