

# BUSINESS PARTNERS

## Ansaldo adds to its accomplishments in burning opportunity fuels

The European Union's commitment to carbon capture and storage (CCS) as a means for mitigating global warming was very much in evidence at PowerGen Europe, held last June, in Milan. Ansaldo Energia presented papers and participated in discussion groups on the subject at that conference.

Fuel-flexible gas turbines (GTs), which operate at high efficiency, are well-positioned to play a major role in reducing CO<sub>2</sub> emissions from the electric-generation sector. Ansaldo, well known worldwide for its V-engine technology, has considerable experience in burning a broad range of opportunity fuels—from gases with very low heating values to ones with high hydrogen contents burned in premixed combustion systems.

The company's R&D efforts are focused on specific E- and F-class customer requirements, and directed toward the expected future demand for pre-combustion CCS and powerplants capable of burning fuels containing more than 90% hydrogen.

The Ansaldo GT fleet currently has about 23,000 MW operating on natural gas and distillate oil and 600 MW on opportunity fuels. The latter group includes several units serving the primary-metals and refining industrial sectors that are running reliably and efficiently on fuels containing varying percentages of hydrogen.

The bullet points below summarize that experience to date. Greater detail is offered by Federico Bonzani, Roberto Garosi, and Domenico Zito in their paper "High fuel flexibility in Ansaldo Energia heavy-duty GTs for precombustion CCS ready powerplants," which is available in its entirety through the COMBINED CYCLE Journal. Write bob@psimedia.info to obtain a copy.

- Elettra GLT, Servola, began operating in 2000 on a mixture of natural gas and byproduct gas from a steel mill. Natural gas as thermal input to the GT ranges from 45% to 49%. H<sub>2</sub>/CO ratio of the 290 psig/500F fuel gas ranges from 0.09 to 0.99, lower heating value (LHV) from 189 to 264 Btu/ft<sup>3</sup>.
- ISAB Energy, Priolo Gargallo, began operating in 1998 on 100% syngas produced from asphalt in

a Texaco gasifier. H<sub>2</sub>/CO ratio of the 319-psig/383F fuel gas ranges from 0.95 to 1.05, LHV averages 180 Btu/ft<sup>3</sup>.

- EniPower, Ferrera Erbognone, installed in 2006 for operation on syngas produced from asphalt in a Shell gasifier. The syngas may be blended with up to 25% natural gas (as a percentage of the total heat input to the engine) when necessary. H<sub>2</sub>/CO ratio of the 319-psig/374F fuel gas ranges from 0.55 to 0.92, LHV from 153 to 179 Btu/ft<sup>3</sup>. Note that the composition of the fuel gas varies with the refinery's demand for hydrogen recovered in the gasification process.
- EniPower, Brindisi, relies on H<sub>2</sub>-enriched natural gas to power two GTs, each of which has more than 15,000 equivalent operating hours on that fuel. The refinery off-gas essentially is a 2:1 mixture of H<sub>2</sub> and CO at a nominal 550 psig/160F. The 420-psig/323F fuel gas delivered to the GT has a LHV of 1262 Btu/ft<sup>3</sup>.

The paper prepared by Bonzani and his colleagues details the steps in Ansaldo's process for customizing its DLN combustion systems for non-standard fuels. It includes (1) collecting fuel data required to develop the optimum syngas nozzle configuration, (2) designing and fabricating prototype nozzles, (3) testing prototype nozzles on the burner installed at the company's Gioia del Colle research facility to evaluate the stability of the flame and its position with respect to the flame holder, and (4) operating the selected nozzle configuration at actual GT working conditions in Ansaldo's Sesta test rig. Sesta allows a thermal input of up to 30 MW to evaluate burner aerodynamics, flame stability in relation to both flashback and blow out, emissions, etc.

Operating experience at Ferrera Erbognone and Brindisi is presented in sufficient detail to be of interest to any owner considering the use of syngas or H<sub>2</sub>-enriched natural gas in an E or F frame. Here's a summary of what the paper has to offer:

**Ferrera Erbognone.** The 167-MW, E-class, V94.2K engine serving the integrated gasification/combined cycle has two silo-type combustors arranged vertically on either side of the unit.

Each combustion chamber has eight burners equipped for burning low-Btu gas as the primary fuel, natu-

ral gas as a backup. Guaranteed emissions profile in units of mg/Nm<sup>3</sup> are NO<sub>x</sub>, less than 50; CO, less than 25; particulates, less than 10.

Relevant modifications made to the standard engine to burn the byproduct fuel are the following:

- Addition of a compressor stage to increase surge margin, needed to accommodate the higher fuel flow rate.
- New burner, to accommodate the low-Btu fuel's specific properties.
- New fuel system, to accommodate (1) the lower energy content of syngas compared to natural gas, (2) the possible presence of toxic and explosive components in the fuel, and (3) both syngas and natural gas and to blend both when necessary and occasionally blend both with steam as well.

Onsite testing confirms the following sequence of operations: Start the GT on natural gas to ensure the highest level of safety and ramp to 40% of rated capacity (66 MW). Then select from the following operating modes: (1) Run the engine at base load exclusively on syngas, (2) run at base load with 65% or more of the heat input from syngas, remainder from natural gas blended with it, or (3) run the engine at partial load from 60 to 100 MW on syngas blended with natural gas.

**Brindisi.** Off-gas composition varies depending on refinery processes. Safe, reliable, and efficient GT operation depends on restricting the off-gas contribution to 10% of the total heat input to the engine. For the two Brindisi GTs, the pilot and startup diffusion flame are fueled by natural gas. Off-gas mixed with natural gas at the fuel skid supplies the premixed flame only after the engine achieves 70% of rated capacity on natural gas alone.

The combination fuel only is burned between 70% and 100% of rated output. In an emergency—such as if the off-gas compressor were to trip—gas from the refinery would be diverted to a flare stack and the engine operated exclusively on natural gas. Commissioning and long-term operating experience indicate that the maximum hydrogen content of the blend is limited to 15% by volume up to 95% of rated load and to 11% from 95% to 100%.

NO<sub>x</sub> emissions increase slightly when off-gas is blended with natural gas, but are well below the regulatory limit of 25 ppm.

## Company news

**Liburdi Turbine Services Inc**, Dundas, Ont, is renewed through 2013 by Rolls-Royce as an Authorized Component Repair Vendor for industrial RB211, Avon, and Spey engines. The agreement covers complete repair of gas-generator blades and vanes, including 20 advanced repairs developed by Liburdi to fully restore RB211 blades.

**Calpine Corp's Columbia Energy Center**, Gaston, SC, receives EPA's Energy Star CHP Award for its 2 x 1 F-class combined cycle system which provides 1 million lb/hr of steam to an adjacent Eastman Chemical plant, thereby allowing the facility to retire several old coal-fired boilers. The 54% efficient CHP system reduces CO<sub>2</sub> emissions by nearly 150,000 tons/yr compared to an onsite steam plant at the chemical manufacturing facility.

**CH2M Hill**, Denver, a global full-service EPC and operations firm is the largest company ever named to the Inc. 5000 list of fastest-growing private companies in the US (based on revenue growth from 2004 through 2007). Its \$5.8-billion revenue in 2007 and 85% revenue growth in the three-year period ranked the company No. 1 in both categories.

**Delta Power Services LLC**, Houston, the fourth largest O&M services provider in the power-generation sector of the electric power industry, is purchased by Babcock & Wilcox Co, Barberton, Ohio, from Olympus Holdings LLC.

## People in the news

**Allied Power Group**, Houston, names Bernhard Rudolph as CFO and Alan Lovelace, PE, as engineering manager.

**M&M Engineering Associates Inc**, Austin, announces that John Molloy received his license as "Professional Engineer, Metallurgical" in the State of Texas. He specializes in turbine-blade coating and casting assessment, failure analysis, accident investigation, etc.

## Product/services update

**E H Wachs Co**, Lincolnshire, Ill, announces the Multi-Axial PowerDrill, a field tool designed for drilling, boring, and tapping pipes of any diameter. Modular design allows quick set-up and easy handling by

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one operator. Optional mounting saddles allow the PowerDrill to be used on pipes or flat surfaces. Visit [www.wachsco.com](http://www.wachsco.com), or call Matt Whitaker at 847-484-2639.

**Petrotech Inc**, New Orleans, introduces its first standalone compressor anti-surge controller with a built-in HMI display. The Em-400 touch-screen HMI gives the operator comprehensive compressor information and control. Visit [www.petrotechinc.com](http://www.petrotechinc.com).

**Aquatech International Corp**, Canonsburg, Pa, introduces the L series in its respected Watertrak™ family of pre-engineered water treatment components. New products based on cutting-edge technology to maximize efficiency include multimedia filters, activated carbon filters,

RO systems, and water softeners. Visit [www.aquatech.com](http://www.aquatech.com).

**ESCO Tool**, Holliston, Mass, announces (1) a rental fleet of welding end-prep tools for boiler tube and pipe from 3/8 in. ID to 4 1/2 in. OD, any wall thickness, any material. No cutting fluids or special training required. (2) Low-profile boiler panel saw and steel track system are designed for removing boiler tube-panel sections in tight areas, easily attached using weld tabs. (3) Line of air-powered straight-rolled and flared tube expander kits match customer requirements for tube OD and wall thickness. Tool provides the proper amount of expansion to create a tight and uniform steel-to-steel mechanical seal between the tube OD and tubesheet. Visit [www.escotool.com](http://www.escotool.com).