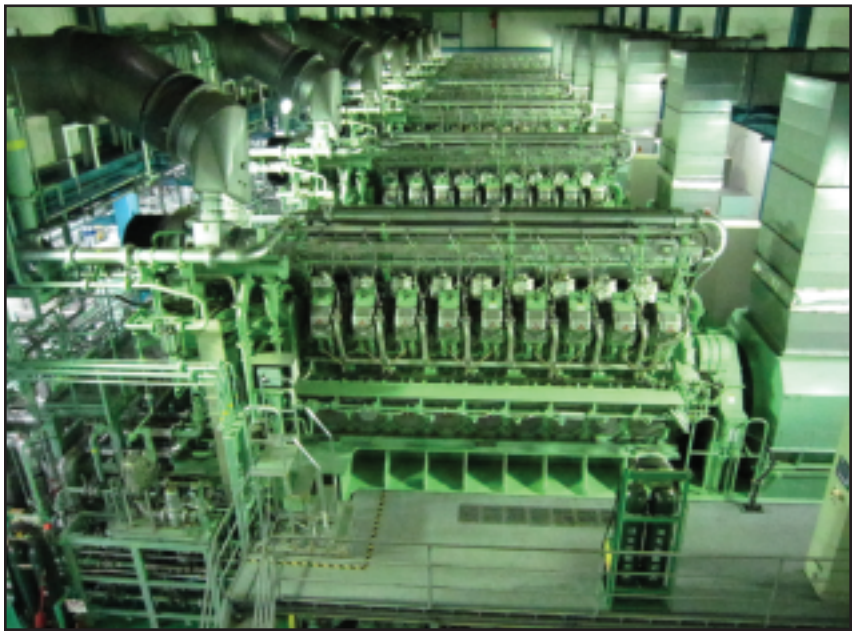
BY SHEILA GAILLORETO



Elpida Memory Inc. recently installed 13 MACH gas engines in their Hiroshima, Japan, factory.

Mitsubishi Power Systems Adds to Its Recip Engine Product Portfolio

MACH II-SI fills 10-50 MW niche with rapid load response, high reliability factor

Mitsubishi Power Systems (MPS), the power systems segment of Mitsubishi Heavy Industries Ltd. (MHI), has been engineering and manufacturing large reciprocating engines for over 25 years. In February 2009, MPS completed development and introduced their newest engine, the MACH II-SI, a natural gas-fueled, 5500 kW engine with an efficiency of 47.3%. All initial system testing has been successfully completed and the MACH II-SI is now commercially available in both 50 and 60 Hz configurations.

Stephen Burris, program manager for new projects, Mitsubishi Power Systems Americas Inc. (MPSA), outlined the range of applications for the MACH II-SI. "One of the primary applications for this engine is providing power generation flexibility to small and midsize utility companies, especially those dealing with increasing wind generation operations within their portfolio or balancing area. Mitsubishi expects the challenge of maintaining stable power generation and transmission levels to continue to grow over the next several years," Burris explained. "In this application, complementary recip power designed to move quickly with load change can be more economical than a simple-cycle gas turbine (especially at partial loads), and move faster than a combined-cycle power plant. The strength of the MACH II-SI is its responsive load following and individual engine control designed to optimize the overall plant," Burris added.

One of the reasons that small to midsize utilities are a key focus of MPS, especially those responding to shoulder and peak loads, is Mitsubishi's effort to provide plant operators more flexibility in "control of their plant comprised of multiple power shafts."

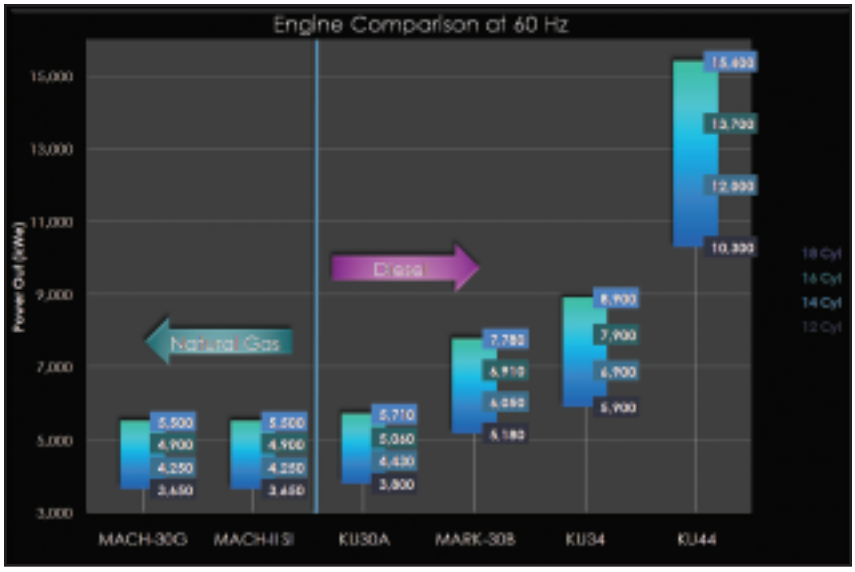
Burris provided further detail, "By dispatching individual engines, we can optimize our overall plant output to operate near each engine's maximum efficiency and lowest heat rate. Depending upon market conditions, the price of fuel and the load demand, this can prove to be a tremendous economic incentive to the owner/operator. Through individual engine control, MPS has the ability to start each engine only when needed.

"For example, as the first engine approaches 100% we can command the second engine to come online. In other words, if it will take a few hours to reach peak load, we only run the minimum engines required along the ramp-up and ramp-down to maximize plant efficiency. This keeps as many engines as possible running at 100%, resulting in a very low overall plant heat input. If modeled properly, the owner quickly realizes a significant economic driver — considering the lifetime of the power plant," explained Burris.

The MACH II-SI is also well suited for distributed generation "micro grid" applications where generating units are constructed at a sub-station. The key advantage to using recip power in this application is gaining improved sub-station reliability, with the option to delay or reduce the addition of costly transmission lines.

"The engine is also well suited for any large commercial or industrial site, for example, a large data center where full-time reliability is a priority. Recognizing the importance of reliable power sources, Elpida Memory Inc. (one of the world's largest DRAM manufacturers) recently installed 13 MACH gas engines in their Hiroshima, Japan, factory to support their continuous manufacturing operations," Burris said. "An ideal situation for this new gas engine would be one where 10, 15 or 20 MW plants with a readily available gas supply and the ability to parallel the engines in a synchronous fashion exist. In Japan, this application is very common and is often utilized at auto plants and steel manufacturers," Burris added.

Cogeneration is a natural byproduct for this engine in the factory setting. Utilizing engine waste heat sources, an owner can boost plant efficiencies to over 70%. From an environmental perspective, another factor in Elpida's



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choice to install the gas engine was its ability to reduce overall CO_2 emissions when comparing the engine's output to equivalent generation sources in use today. The engine also has the capability and versatility to be operated in oil and gas applications in the areas of compressor power and distributed electrical generation for field operations.

Both the individual engines and the overall plant are controlled by the Mitsubishi Diamond System (DIASYS). The DIASYS control system is the same control system used in Mitsubishi's larger gas turbine power plants based upon NETMATION digital control. The engine's combustion system is built upon past success within MPS using the Mitsubishi Real Time Intelligent Control System (M-RICS) integrated with a state-of-the-art Solenoid Gas Admission Valve (SOGAV)-based advanced combustion control.

Employing a simplified pre-combustion chamber design and modern turbocharger technologies, the engine is far less sensitive to elevation and climate conditions when compared to combustion turbines. In fact, the MACH II-SI engine exhibits a very flat heat rate curve when operating at site elevations up to 1500 m. Burris explained that it is a robust system that can handle ambient temperatures above 32°C. "This engine will perform very well both at high altitudes and in hot environments," Burris said.

The scope of equipment supply includes an enclosed power block consisting of the engine, generator, basic auxiliaries, emission control, basic plant control and secondary cooling system components. Additional options include advanced plant control system integrations, cogeneration systems, closed-loop radiator cooling and additional noise suppression equipment (to support operations in small, noise-sensitive installations). The radiator is ideal for those areas with limited access to cooling water, as the MPS engine requires no injection water for operation.

Building on over 25 years of experience, the MACH II-SI is the newest addition to a lineup of large engines designed and built for stationary power applications. The MACH II-SI was developed based on the company's existing MACH-30G, which has a large in-service engine population in existence in Japan today.

The MACH-30G uses a "micro-pilot" ignition system while the new MACH II-SI has adopted a spark ignition system that eliminates the need for auxiliary liquid pilot fuel, thus simplifying installation and lowering plant operating costs. The development of the MACH II-SI focused on both efficiency and operational improvements by leveraging accumulated engine design experience.

MACH-II SI starting time is advertised as less than seven minutes, although it can actually start in much less time under specific conditions. This represents more than 50% performance improvement compared to its predecessors. For system operators, this also contributes significantly to improved load-following capability.

In order to boost power generation efficiency, MHI enhanced the overall combustion system. By optimizing the formulation of the air-fuel mixture, as well as improving the pre-chamber's shape and air-fuel mixture ratio, the company has raised combustion efficiency and reduced thermal loss. Of interest to plant operators and maintainers, the MACH-II SI engine has demonstrated exceptional availability following several thousand hours of in-service use.

A direct sales team based in Lake Mary, Florida, U.S.A., manages all application and sales transactions for North America. A team based at MHI in Yokohama, Japan, conducts application and sales for the MACH II-SI for all other regions. MPSA has developed a plan to continue its record of successful field support of MPS products. MPSA, working directly with MHI, is now ready to provide its engine customers with both parts and maintenance support that begins at plant commissioning.

Since its introduction in 2002, MHI has delivered more than 150 units of the MACH gas engines. The MACH design is based upon the legacy KU30A diesel engine. Several hundred KU series engines have been placed in service with individual engine frames accumulating over 170 000 hours of successful operation.

Today, MHI operates a "Customer Service Center" at its Yokohama Machinery Works — providing 24/7 remote service support to both domestic and international customers. Services are provided on a contract basis for both operational and emergency service support of their users.

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