

Turbine Maintenance Market Heats Up

The market for repair services for F-class machines is growing.

By Nancy Spring, Senior Editor

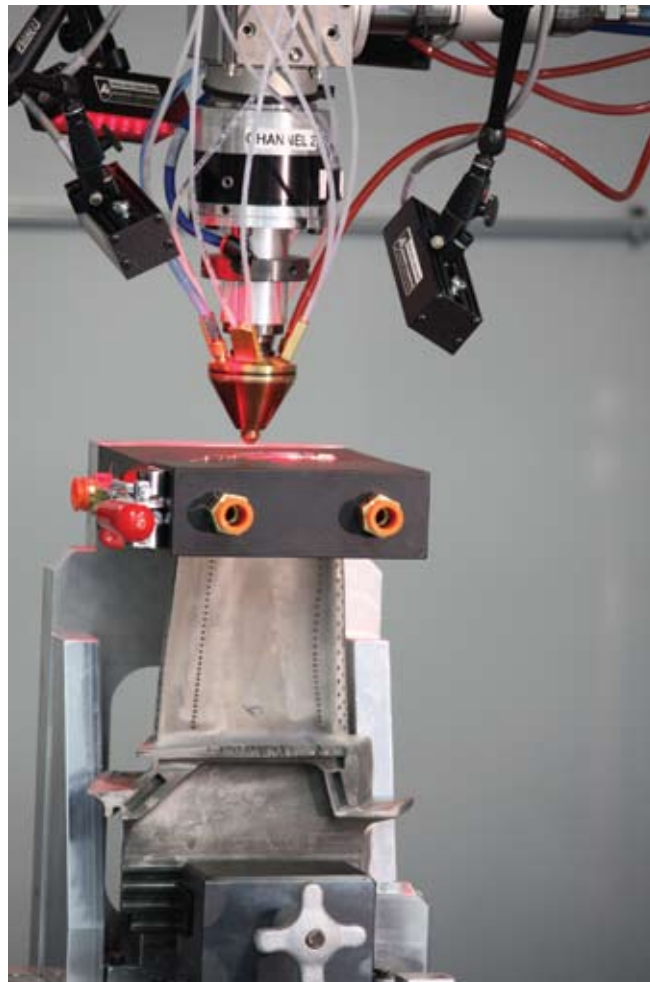
Despite its price volatility, natural gas is still the technology of choice for many power plant projects. In 2009, 23,475 MW of new generation capacity are planned in the U.S. Of this, more than 50 percent will be natural gas-fired additions. Or as the Department of Energy puts it, 900 of the next 1,000 U.S. power plants will use natural gas.

And what about existing plants? In 2007, the Energy Information Administration counted more than 5,000 natural gas-fired plants in the U.S., with a nameplate capacity of almost 500,000 MW. All ages and sizes, these plants have to be maintained to be efficient and reliable.

There are two markets here, said Turbine Energy Solutions President Ron Natole: the older, mature designs and the newer F-class technology, with its higher firing temperatures. Repairs and durability are specific for each set of turbines. (See Table 1.)

Natole said that at one point almost 70 percent of turbines were covered by original equipment manufacturer (OEM) long-term service and parts agreements, so few if any of the independent repair companies got to work on them. But that started to change in the last several years.

“We think that by 2011 more than half of those machines will not renew their long-term service agreements and that will provide an opportunity for after-market repair, after-market



Turbine blade tip repair at Alstom's repair and reconditioning facility in Jupiter, Fla. Photo, Alstom.

TABLE 1 TURBINE DESIGN DIFFERENCES

Technology	Models	Turbine Inlet Temps and Component Features
Older Units 1950-1975	GE3, 5 & 7B/C W191, 251 AA & W501AA ABB 11D	1350 F - 1750 F Mostly solid TB airfoils Some TB Vane/Noz cooling Few coatings, simplex only
Mature Designs 1976-1985	GE6B, 7E, 7EA W251B-B8, W501B-D5 ABB 11D5-N	1800 F - 2050 F Radial-cooled TB blades/bkts (Stgs 1 & 2) TB blade coatings Nozzle/vane segs cooled (Stgs 1& 2) Compressor coatings
Advanced Technology 1985-	GE7FA, 7H S-W 501F & G ABB GT24/26 Siemens V84/94.3A	2300 F - 2600 F Complex multi-pass cooling Duplex Coatings DS & SC TB Bld. Alloys Dry emission combustors Coated compressors

Source: Natole Turbine Enterprises

services and after-market parts,” said Natole. “There will be a whole new class of machines that was once covered by long-term service agreements.”

F-Class History

Traditionally, many of the machines were sold as pure peaking units, said Natole. They were lucky if they ran 200 to 500 hours a year. The only machines that were run base-loaded were sold to self-generators—like refineries—where they were critical to the manufacturing side of the business. Those sales probably represented less than 10 percent of the installed fleet, said Natole.

Then along came the F-technology plants, which were

originally designed to replace coal-fired plants to balance the grid. Coal-fired boilers were slated for replacement by combined cycle gas turbines to cut emissions.

“Almost all of the F-technology were steam turbine plants,” said Natole. “Gas turbines can be started up cold and be up and running at full load in under 30 minutes, not like the massive coal plants.”

But when the majority of these machines were sold, from about 1995 to 2002, that didn’t happen. Many of the F-technology gas turbines that were intended to be run on base load are now being run on intermediate cycling. That means the machines may run 2,500 to 5,000 hours a year mostly, during the work week between 7 a.m. and 7 p.m. “They could typically have 250 to 350 starts per year and that raises hell with a big old gas turbine like that,” Natole said.

Today, there’s another reason pressure for availability and reliability of gas turbines is growing: the desire to install more wind power to cut back on carbon dioxide emissions.

“The installed base of wind could build up to 50 GW or more in the next five years and much of that wind capacity has to be backed up with standby capacity,” said Ron Cox, vice president, Alstom Turbine Generator Service–Richmond. “And that’s usually a gas turbine.”

In addition, there could be less demand for new coal plants in some parts of the country and one alternative will be F-class gas turbines.

Out-Engineering the OEMs

Repair and maintenance on gas turbines is fairly predictable.

“It’s always the same parts, it’s just a question of how often and how bad it is,” said Natole. “The capital parts are the hot gas path parts and the parts that get it the most are the combustor parts in the first couple of stages in the turbine section.”

Turbine Energy Solutions sells replacement parts to power generators themselves as well as to major repair

and service organizations like the Wood Group and Turbo Care.

“Having refurbished spares available before you start the outage is absolutely critical or you could be down four to eight weeks instead of two to three,” said Natole.

One major O&M variable depends on how the plant is operated: Is it peaking, intermediate cycling or base load? The difference is the number of stops and starts, which can lead to thermomechanical fatigue cracking.

“The more you start and stop a machine, the more cracks you get,” Natole said. “With time those cracks grow longer until you go from a minor repair to a major repair.”

The bad news is repairs and parts for the advanced technology machines are expensive. Natole expects costs to be almost five times more for the F-class than for more mature designs.

As demands for improved emissions, greater output, more efficiency, longer lifetime and enhanced reliability continue, R&D activities explore advances in materials and engineering.

“Our largest customers want reliability and availability,” said Bob Kraft, president of Power Systems Manufacturing, a unit of Alstom and an aftermarket company selling components for Siemens and GE equipment in the gas turbine business. “They want to be sure the engine is available when they need it and that it won’t break when they are using it.”

To that end Power Systems’ engineers work to design parts that are better than the originals. Several of the company’s customers are running “first” products today in the combustion and air foil area and recently, Power Systems released a new row zero compressor blade solution for 7FA gas turbines equipped with a flared compressor design.

Failure incidents had been reported with the 7FA gas turbines that resulted in operating restrictions on inlet-fogging and on-line water-washing. Power System’s blades have been validated on an engine in normal commercial service for more than a year. The new blade sets

are a direct replacement installation and require no other engine modifications.

“We designed a new part that doesn’t have the reported issues the OEM part had,” said Kraft.

For a weld repair on a six-year-old 501F generator rotor that suffered a major crack, the OEM offered a temporary solution. Instead, Power Systems cut the generator forging and rewelded a new forging on it, then shipped it back to the customer.

“We also have a solution for an issue on the stators on the front end of the compressor on the 501F,” said Kraft.

HPI, LLC is also seeing an increase in overhaul and maintenance of turbine mechanical systems, including steam turbine overhaul.

HPI was awarded a major turbine overhaul (MTO) project in June with South Carolina Electric & Gas (SCE&G) at the Hagood Generating Station near Charleston. The project will include inspection of the hot gas path on a Westinghouse W501D5 and four rows of blade removal/replacement with the rotor in place.

HPI’s mechanical group uses borescope inspection technology, which can detect signs of machine degradation before there is damage to rotating equipment, loss of production and/or unplanned outages. Based on inspection results, the mechanical group also provides equipment repair, including manufacturing, installation and maintenance of peripheral support systems beyond traditional turbo machinery.

Natural gas turbines will continue to power their share of U.S. generation and these companies have made a firm decision to invest in that future.

“Right now we are seeing deferments of capital investments and reductions in maintenance spending,” said Alstom’s Cox. “Because of the economic slowdown, we have seen electricity demand go down, but it will upturn again when the economy rebounds.” **pe**