COVER STORY

PARTS: A PYRAMID OF CHOICES

MORE NON-OEMS MAKE IT THEIR BUSINESS TO SELL AND SERVICE TURBINE COMPONENTS

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When industrial gas turbines malfunction, the first thought is to call the OEM. Who better to identify the problem and determine if the damaged components should be repaired, refurbished, rebuilt or replaced?

Try the growing cadre of independent suppliers of New Alternate Source Parts (NASPs). With experienced hands inhouse, computer-aided design tools, and a catalogue of advanced materials, parts and coatings, NASPs are vying for a larger share of the international turbine aftermarket (Figure 1), with an installed base three times that of the U.S. (Figure 2).

In addition to selling all-new components, they install and repair equipment, and do it in less time and for less money. In fact, the average selling price of a NASP is about half, or 40% – 60% that of a new OEM component, says Ron Natole, an industry consultant with more than 42 years of experience in the turbine business.

Occupying a niche

Far from toppling the OEM monopoly on the global $10 billion/year market for turbine replacement parts, NASPs are carving out niches that are too small, too old or too new for OEMs. Even so, NASPs are a respectable business, raking in $200 – $300 million/year.

Before 1980, only a handful of companies identified themselves as NASPs — a term that Natole says he coined — but at least 15 have set up shop in the last 10 years. "The industry is poised and ready for change and we are trying to change and adapt with it" says Joe Cosart, President of Advance Combustion Technology (ACT; Houston, TX), an independent parts supplier. "We are in a strategic expansion mode."

So is Turbine Energy Solutions (TES; LaPorte, TX), Natole's startup. Since January, the company has been operating out of a 20,000 sq. ft facility outside Houston, selling off-the-shelf NASPs and refurbished components, along with new surplus parts and rotors. The company expects to deal with primarily older, mature equipment models from the major OEMs. While repairs will be outsourced, customers will be able to check parts availability and inventory online.

Figure 1: Many non-OEM vendors boast an off-the-shelf supply of parts for a range of gas turbine models

"To control operational costs and provide long-lasting repair, power plant owners will rely more on alternative solutions," says Davis. "One effective option is Frarendi's replacement coupon technology."

Replacement of rotating and stationery parts that have finite life or parts that cannot always be refurbished or reused are our niche, says Natole. By the end of the first year of operation, he expects TES to be the largest independent supplier of off-the-shelf parts. Thereafter, he expects sales to quickly double as the company expands internationally. Part of his strategy, for example, is to target Europe and the Middle East.

Boding well for turbine parts suppliers is the positive outlook for turbines. Global demand is projected to increase 4.9% annually through 2012, according to market researchers at The Freedonia Group (Cleveland, OH). Bright spots include China and India, where gains will be slow, yet remain well above average rate, with smaller Asian markets, such as Indonesia, Malaysia and Pakistan growing even faster. In Europe and the U.S., heightened concerns about the environment are prompting conversions from coal-fired to combined cycle power plants. As coal falls out of favor, the deregulation of U.S.-produced energy sources has allowed for more competitive pricing in non-OEM products, says Allied Power Group (APG; Coconut Grove, FL). As a result, its replacement parts and repair business is booming. Ranked in 2007 as one of the fastest-growing privately held companies in the U.S. by Inc. magazine, APG reported a

MODEL SPECIFIC G.T. POPULATION DATA

Manufacturers Models	USA #Units	WORLD #Units
Alstom Power		
GT8-50 & 60Hz	10	56
GT9-50 & 60Hz	2	104
GT11-60Hz	152	394
GT13-50Hz	0	263
GT24-60Hz	72	91
GT26-50Hz	0	69
TOTAL	236	977
General Electric		
GE5-50 & 60Hz	972	3141
GE6B-50 & 60Hz	171	951
GE7B/EA-60Hz	791	868
GE7F-60Hz	789	1107
GE9B/E-50Hz	0	541
GE9F-50Hz	0	208
TOTAL	2723	6816
Siemens-West		
V-64-50 & 60Hz	8	83
V-84-60Hz	90	143
V-94-50Hz	3	606
TOTAL	101	832
W191-50 & 60Hz	105	179
W251-50 & 60Hz	138	373
W501B-D5-60Hz	304	500
W501F-60Hz	229	282
W701-50Hz	6	213
TOTAL	782	1547
TOTALS	**3842**	**Approx 10-11,000**

TBES/ Forecast International 7-08

Figure 2: The global installed base of gas turbines as per model and geographical location

Source: Turbine Energy Solutions

three-year revenue growth of 542.8%, from $1.9 million in 2003 to $12.5 million in 2006.

Poised to stay on the fast track, APG will consolidate its headquarters, sales, repair shop and warehousing operation when a new 70,000 sq. ft facility that the company is building in Houston is completed in December. "The unique value of APG is that we provide both turbine replacement parts and expert repairs, all from a single, proven source," says CEO Bruce Agardy. "Our new facility will allow us to truly be a one-stop shop for turbine owners."

Specializing in the repair of gas turbine components including hot-gas path and combustion components, APG boasts a "large" inventory of GE Frame 5, 6, 7 and 9, as well as a wide selection of components from Westinghouse and other OEMs. When the new facility is ready, the company will expand its product line to include Westinghouse 501F turbine parts and extend its repair capabilities to include steam turbines.

Similarly, Turbine Resources Unlimited (West Winfield, NY) offers new and used spare turbine parts and an acquisition service. For parts that it does not stock, hard-to-locate or even outdated turbine components, the company will locate a source.

Bargain coupons

At Frarendi (Tipton, IN), Mark Berube, Director of Sales, is impressed with sales of its coupon repair process for first-stage nozzles. Developed and tested over a number of years, the proprietary process was used sparingly. But when Kevin Davis bought the company a couple of years ago and took over as president, he lifted the veil of secrecy.

Erosion of first-stage nozzle trailing edges, particularly as they are used for power generation, compromise nozzle integrity, the turbine in which it is used, as well overall plant efficiency.

Traditionally, gas turbine owners and operators had two ways of fixing this problem: They could either replace eroded first-stages nozzles or repair them, typically by welding cracks and missing sections, but there are drawbacks to both. Repeated weldings weaken the nozzle, increasing the likelihood of more repairs and downtime; replacements can be costly. Instead of replacing the entire nozzle, Frarendi retrofits the device with a coupon made of the same cobalt-based FSX-414 alloy used to fabricate the base metal of the nozzle. The coupon is made to the exact geometric and dimensional specifications of the original vane, and intricate cooling holes are machined into each coupon using an electro-discharge machining process. Quick, inexpensive and metallurgically sound, the coupons restore the integrity and extend the service life of nozzle, says Davis.

Started up 10 years ago, ETS Power Group (Stuart, FL) designs and makes turbine components that are comparable or equivalent to those made by OEMs.

These OEM-equivalents reflect the company's technological know-how in aero engineering and experience in turbine maintenance and repair. "We know what happens to parts with 48,000 hours of run time," says Mark Dender, ETS' cofounder and Vice President. Although ETS' costs-to-manufacture an

GT PARTS PURCHASE CRITERIA

NEW PARTS	USED PARTS
HISTORY	HISTORY
1. Who Manufactured the Parts? 2. When were they Manufactured & Where? 3. Are Certs Available?	1. Where did the parts come from? 2. How many Fired Hours & Fired Starts? 3. What Kind of Fuel? 4. Mode of Operation: Peaker, Cycling, Base Load?
SPECIFICS	SPECIFICS
1. Model/Style 2. Material & Coating 3. Cost of New vs OEM & Others 4. Availability - Stock or MADE TO ORDER (MTO)	1. Model / Style 2. Material/Coating 3. OEM or Other 4. Homogeneous Set? 5. Cost to Purchase & Delivery Time
ACCEPTANCE INSPECTION	REFURBISHMENT
1. Receive and Visual 2. Sample LPI & Dimensions 3. Fixture / Form Fit 3. Certificate of Conformance: Chemistry, Hardness, Mechanical Strength X-Ray, FPI, Heat Treat, Coating, Shot Peen	1. Minor, Meduim, Major Repair 2. Cost vs New (OEM & Others) 3. Work Scope & Completion Time 4. Repair Shop Verification

Figure 3: OEM parts, as well as New Alternate Source Parts, are expected to follow the same purchase criteria. In the above, FPI is Fluorescent Penetrant Inspection and LPI is Liquid Penetrant Inspection

equivalent component are many times higher than those incurred by its OEM counterparts, the difference is offset by the lack of corporate overhead that OEMs must shoulder. "OEMs cannot compete with us because there is too much inertia," says Luke Hmiel, ETS' Design Manager. In addition to its manufacturing capabilities, ETS repairs its equipment and that from other suppliers, and provides fleet logistics, maintenance and risk management services.

Global ambitions

Started up as a supplier of 50 Hz generators, which were more widely accepted in South America and regions of Europe than in the U.S., ETS is making international inroads with its turbine parts. A concentrated area of focus is the Middle East.

Through 2010, the company expects to identify more than twice as many growth opportunities in the Middle East than it has to date. "Not a single dollar was sold there in 2005; but we see a large market for ETS," says Dender. In China, where ETS has been doing business for five or six years, there has been a tremendous investment in economic development leading up to the Olympics that Dender expects will continue. Recently ETS signed an 18 year agreement with Fauji Foundation for new parts and repairs in Pakistan.

Often overlooked are the cost benefits of component repair and maintenance, says Lloyd Cooke, direction of operations for Liburdi Turbine Services (Dundas, Ontario). Typically, turbine owners and operators who frequent different parts suppliers and repair shops spend more and save less than those who use a single, reliable source.

For example, most repair shops service either lightweight aeroderivatives such as Rolls Royce, or heavyweight gas turbine GE frames, but not both. Liburdi is an exception. "We have an advantage," explains Cooke, "because technology developed for aeros has trickled down to heavy-duty frames."

OEMs and independent parts suppliers are looking to stake a claim in Latin America's energy-rich territories. While the U.S. remains the largest market for Liburdi, accounting for about half of its business, growth is global. "More and more operators are seeking service and repair that they want," says Cooke, noting the price of oil. "Shipping costs are incidental to lifecycle costs."

Suppliers that have operations in Florida, Houston or other points south in the U.S., are strategically positioned to take advantage of emerging market opportunities in Latin America. As the region harnesses its abundant reserves of natural gas and coal to meet its requirements for power and fuel, demand for turbine parts and services is expected to increase, surpassing 2007's $3.2 billion in revenues, to reach $5.37 billion in 2012, according to market analyst Frost & Sullivan.

Currently, the greatest investments, in terms of energy supply, are directed at thermal plants, inducing a change in the energy matrix of various countries in the region, says Tamara Dvoskin, Industry Manager at Frost & Sullivan. As thermal generation moves to the forefront, interest is surging in steam turbines, as well as combined cycle power plants.

The abundance of coal and biomass in the region, and the daunting prices of oil and natural gas, also help push the uptake of steam turbines. The insufficient capability to service turbines efficiently in-house and high profit margins of service providers, mainly original OEMs, will also fuel the gas turbine services segment.

Fierce competition between OEMs will require end-users to make an informed choice between the product quality that is the standard bearer of OEMs and the attractive costs savings offered by independent suppliers and repair shops. The low technological characteristics of steam turbines require little specialization, says Dvoskin, while gas turbines have state-of-the-art servicing activity that smaller participants cannot meet.

Terms of engagement

Long Term Service Agreements (LTSAs) are an increasingly popular

option. They are lucrative, too, with terms of 20 years to 25 years as part of the package. Widely used by OEMs, they are being offered to a greater extent by NASPs and other ISPs.

"Service providers' willingness to take risks will determine their success. For instance, providing attractive, cost-effective service packages that go beyond simple spare parts supply, to offer additional features, such as heat rate, insurance on availability, and output, will make the contract assume the dimensions of a low-risk investment for the plant owner, attracting more takers," suggests Dvoskin.

Just as some turbine owners shy away from LTSAs, some independents question the feasibility of such deals. "LTSAs lock operators in," says Liburdi's Cooke.

While some "wanna-be OEMs" offer LTSAs, too, transactional purchases are preferable because they give the operator the flexibility to buy parts off-the-shelf as they need them, adds Natole.

Traceability is a sticky issue because OEMs do not necessarily make all of their parts, he continues, but they charge a price premium of 1.5–2.0 over NASPs. What is more, OEMs and others buy NASPs for captive use in their new gas turbines or to sell them on a contractual basis. That "seal of approval" is proof that "OEM and NASPs follow the same purchase criteria." (Figure 3).

OEMs, for their part, find that the spares and components for their equipment are often re-engineered or reverse engineered, reports Frost & Sullivan.

Parts vendors and local companies manufacture and supply counterfeit spares (mostly without the official knowledge of plant owners), which do not conform to the standards or specifications and are of poor quality. In addition, the old parts are repaired, refurbished, painted, and even sometimes sold as new parts.

Beware of brokers

Check out the Internet. Ebay, Craig's List and other legitimate auction sites are not the only ones buying and selling goods and services online. Unscrupulous and illegitimate equipment brokers are more easily found in cyberspace than they are in an office space. The fakes are easy to spot. "If you are dealing with people who do not know the nomenclature, do not know where their parts are, and you cannot find them, it should be obvious that you are dealing with people who do not know the business," says TES' Natole. "Know thy vendor."

To sidestep these pitfalls, turbine operators need to be familiar with the products and services they use, says Liburdi's Cooke. For example, TurboCare (Chicopee, MA) has expanded its training program for rotating equipment maintenance and reliability to include vibration analysis, balancing, and alignment as well as instruction geared to improve the reliability and efficiency of steam turbines. Cooke is scheduled to give a short course, Gas Turbine Basic Metallurgy and Component Repair at the 37th Turbomachinery Symposium at Texas A&M University in Houston, Sept. 8–11.