

Power RE-View



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Points of Interest in this Newsletter

- Coal makes a comeback
- What makes a gas turbine a proven design?
- More power capacity is coming on-line as Merchant Plants
- Distributive Power is gaining acceptance due to reliability and supply concerns
- Aging Transformers have greater exposures

Power Industry Rediscovered Coal

During the last decade, combined cycle plants fueled by natural gas were the technology of choice for the power industry. This was due to its low capital cost, ease of permitting, and quick timeline for installation. However, natural gas, once abundant in supply and rather inexpensive, is becoming a victim of the supply and demand principle.

Natural gas prices are rapidly increasing—97% over the last year. With so many new power plants being proposed (see article on page 3 concerning Merchant Power Plants), concerns about supply due to pipeline limitations are increasing. These conditions have made long-term natural gas supply contracts difficult to obtain at best, forcing a renewed interest in coal to fuel power plants.

There are several factors that lend credibility to the consideration of coal. First, due to technology improvements, coal can be burned more efficiently and most importantly within environmental compliance regulations. Secondly, indigenous coal reserves are substantial with improved mining techniques. Finally, governmental support seems to exist.

However, there are issues that can impact underwriters.

1. The operating track record for these new technologies may not be as complete. Harmonization and integration issues with existing technologies increase the risk exposures. This is especially relevant for coal gasification.
2. Due to retirements and downsizing, much of the expertise of the original equipment manufacturers (OEMs) has been lost. As a result, they may not be able to respond quickly and efficiently to solve technical problems, leading to extended business interruption.
3. OEMs’ manufacturing capabilities have diminished, impacting deliveries and spare parts.

Gas Turbines—When are they of “Proven” Design?

Everybody expects new equipment to work well—Car manufacturers go through extensive and costly efforts to shake out the “gremlins” before offering a new model to the general public. This minimizes costly recalls.

Unlike cars, however, some of the very *big gas turbines cannot be run extensively under a full load*. The first true test comes when they are installed in a customer’s power plant. The Original Equipment Manufacturer (OEM) of these large gas turbines will usually try to negotiate a deal with the buyer of the very first model of a new

$$\begin{array}{c}
 \text{3 same model} \\
 \text{machines} \\
 \times \\
 \text{each with 1+ years of} \\
 \text{successful operation} \\
 = \\
 \text{Proven Design}
 \end{array}$$

line of turbines where the OEM has access to the unit during the first year of operation to take careful measurements

to verify that everything is working properly. This is critical since unexpected downtime may translate into a huge loss of revenue. (Every 100 MW of unavailable power amounts to \$240,000 loss of revenue or more.)

Problems which surface may be taken care of by the OEM quickly and generally at no expense to the customer. This certainly was the case during the introduction of the 7F (General Electric) and the GT24 (ABB, now Alstom Power).

As a general guideline, to be designated a “proven” design, an OEM must have at least three units in successful operation each for at least one year. Successful operation may be defined as generally trouble free, apart from minor problems that can be corrected easily. Be aware, however, that a proven design may be moved back into the unproven category if generic long-term problems surface. This requires careful and continuous monitoring of a fleet’s problems by knowledgeable professionals who are then able to advise insurers and others about a particular turbine application.



Photo courtesy of Erich Lichtsteiner, Rode & Associates, LLC

Understanding the Alphabet Soup of Gas Turbine Designations

While most of us recognize that A6, Q45, 747 or A340 are either car or airplane models, we all have more trouble with gas turbine designations. Do these designations make sense? Is there a logical pattern to gas turbine designations?

Concentrating on only large gas turbines used in generating electric power, note the following in no particular order.

Siemens Westinghouse Power

The model designation either starts with a W (a model which was developed by Westinghouse) or a V (designating Siemens developed units). Examples are:

V64.3A	(68 MW)
W501D5A	(120 MW)
V94.2	(157 MW)
W501F	(186 MW)
V94.2A	(189 MW)
W501G	(253 MW)
V94.3A	(265 MW)

All “W” models serve the 60 Hz markets, all “V” models serve the “50” Hz market except for the V64.3A, which serves both. In the case of “V” models, the letter “A” stands for latest technology versions of the frames while for “W” models the ascending letters (D, F, G)

indicate the newest versions of the model.

General Electric

Examples are:

6FA	(70 MW)
<i>50 and 60 Hz markets</i>	
7EA	(85 MW)
<i>60 Hz market</i>	
7F or 7FA	(171 MW)
<i>60 Hz market (FA is the later version)</i>	
9E	(123 MW)
<i>50 Hz market</i>	
9EC	(169 MW)
<i>50 Hz market</i>	
9F/FA	(255 MW)
<i>50 Hz market</i>	

The number “7” always indicates a frame serving the 60 Hz—the number “9” the 50 Hz market. The newest frames are the G and H models, which are currently being introduced into the market.

LM Aero-Derivative Frames

The LM designation stands for “Land” (power generation and mechanical drive applications) and “Marine” (ship board) applications.

The various models are:

LM2000	(18 MW)
<i>(same as LM2500 but derated)</i>	
LM2500	(23 MW)
LM6000	(44 MW)

The numbers have no particular meaning other than larger numbers equal more power.

Alstom Power

ABB Alstom Power is now Alstom Power with their large gas turbines designated as follows:

GT11N2	(117 MW)—“11” stands for 60 Hz, “N2” being the latest model
GT13E2	(165 MW)—“13” stands for 50 Hz, “E2” being the latest model
GT 24	(183 MW)—a new model, 60 Hz market, two (sequential) combustors
GT 26	(262 MW)—similar to GT24 but for 50 Hz market

“GT” obviously stands for gas turbine while the numbers indicate size.

50 Hz vs 60 Hz Service

Gas turbines designed for 50 Hz service run at 3000 RPM. Because of the lower speed (compared to the 60 Hz, 3600 RPM turbines) and equal tip speeds on the last stage blading (a technological limit), the 50 Hz turbines are much larger in size than the 60 Hz machines. As a result, much more power can be produced.

Merchant Plant Capacity Soars

The total amount of planned capacity additions announced by merchant plant developers has skyrocketed in the last two years. According to the Electric Power Supply Association, planned capacity additions total more than 250,000 MW, more than quadruple the announced total from one year ago. They attribute the increase to market demands for generation reserves, greater system reliability and uncertainty with utility restructuring.

Note that merchant plants differ from regulated power facilities in two important ways:

1. Merchant plants have no guaranteed rates of return.
2. They typically do not have long-term power sales contracts.

What are the Implications?

1. Expect more inquiries (Boiler & Machinery, Property, Builders' Risk) for new power plants.
2. Since most of the new capacity uses natural gas-fired gas turbines, the factors for underwriting gas turbines will have increased importance. OEM support, spare

parts, manufacturing capacity, etc. will be stretched.

3. Business Interruption claims may be more difficult to resolve without a pre-defined formula since merchant plants have no long-term contracts. (See GeneralCologne Re Boiler and Machinery Utilities Reference Manual.)

“Unfortunately much of the country is still likely to face reliability challenges in the years ahead due to lack of generation investment.”

4. Natural gas supplies may not be adequate to fuel this high number of plants.
5. The names of the merchant plants owners may not be recognizable as limited liabilities companies are established to own and operate these facilities. It is important to know who is behind the plant.



Turbine Industry News

Alstom Power has taken over the power generation business (except for the nuclear business) from ABB. Included are gas turbines such as the GT24/26 types, which were developed by ABB. According to Alstom sources, reserves have been established to correct design problems with the GT24/26 gas turbines. Of the 79 units sold, 25 units are in service, of which 8 have been modified. Another 6 units were shut down for modifications (status as of end of 2000). A total of 48 units are in production or are being installed and presumably will be modified prior to being put into service. Alstom has budgeted 903 million Euros (approximately US\$860 million) to cover expenses related to correct GT24/26 problems. (Source: *Wirtschaft*, November 8, 2000, p. 27)

The LM2000 aero-derivative has recently been introduced by S&S Energy Products to be used for the power generation market. It will produce 18 MW of power or also be used for mechanical drive applications. The LM2000 is a derated LM2500 with a lower firing temperature and increased intervals for hot section replacements.

According to a publication of ALLIANZ Munich, the losses experienced with F Class gas turbines are higher than losses of the older E Class turbines. Losses of US\$1.2 million (average) were experienced with E Class technology that increased to US\$1.7 for F Class technology. This is not unexpected since the F Class turbines employ more expensive and exotic materials.



Photo courtesy of Dennis Milewski, *The Locomotive*

Aging Transformers Represent Greater Risks

The failure rate of transformers is expected to rise sharply in the coming years as units installed in the 1950s and 1960s reach the end of their useful life, which is 30 to 40 years under ideal conditions. According to HSB in their Winter 2001 issue of *Locomotive*, the average failure age of utility transformers is 17.7 years. Although predictive maintenance practices can

provide useful trending information about the deterioration of transformers, transformer failures remain a significant loss event due to the repair expense and time involved. Few utilities have large transformers as inventoried spares. Therefore there is considerable impact upon insurers for business interruption expense as well.

Make Room for Distributive Power

The California energy crisis has spurred interest in Distributive Power (DP). The crisis has led to increased interest in renewable energy technologies, market acceptance of microturbines, and renewed interest in small diesel-generator plants.

1. Occupancy labels may not be all inclusive. For example, a florist will not only have a greenhouse, but may now also have a combined heat and power plant.
2. The operating histories for the renewables is not extensive and in some cases, such as wind turbines, not very stellar. Evaluations of these technologies in terms of performance sustainability are important because they could impact the core business.
3. The technical and commercial support of their products by OEMs bears watching.
4. Do the owners of distributive power plants have the expertise to operate these plants, or will they subcontract this work to a service provider? The contract with the service provider will have major influences upon the plant's maintenance philosophy.
5. Fuel cells involve the eventual use of hydrogen. The storage and handling of hydrogen is important in terms of detection and system controls used to avoid safety risks.



Lessons From Losses... GeneralCologne Re Claims Activity

What does it cost to replace a boiler?—More than you think!

In 1999, GeneralCologne Re reinsured a large mid-western utility, and we were involved in a catastrophic loss suffered early that year to a generation unit of this account. The output of this unit was almost 500 MW and consisted of a coal-fired boiler which produced 3.5 million pounds/hour of superheated steam at 1005 degrees F and 2500 psig which then turned a steam turbine generator. The unit, which came on line in the late 1960s, had a reasonable operating history. A catastrophic natural gas explosion (used as an igniter) in the boiler occurred while being brought on line which resulted in its total loss.

Viewed as a straightforward power boiler, albeit of some age, the replacement cost was considered to be in the mid-\$90 million range excluding pollution control, coal preparation and handling equipment. This number was based on data acquired over time from new construction projects. However, the replacement cost has turned out to be between \$120-130 million, over a 30% increase! What then, has driven the increased boiler replacement cost?

First of all, with all such projects there are costs associated with debris removal, which typically are not part of a grass roots project. At this plant, the damage was localized to the boiler and included its ultimate removal and replacement—including the foundations. Secondly, as the original boiler was over 30 years old, there are always the issues of new (or current) technology and improved output.

Finally, this construction project represents the first boiler of this type and size to be built in the U.S. in over 10 years! Due to the limited demand, experienced designers and contractors are in short supply, which drives up the cost.

Does this mean that all boilers now cost over 30% more to build? One should not make a blanket statement based on only one example. However, it is clear that replacement cost will be higher than what our experience or previous data tells us. Until we can gain a broader base of current experience, it would be safe to assume that replacement costs may be at least 25% higher.

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About This Newsletter

The Power RE-View reports on evolving issues of interest to underwriters relevant to today's global electric power generation industry.

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