GER-4208

GE Power Systems

Creating Owner's Competitive Advantage Through Contractual Services

Harry G. Stoll
GE Power Systems
Schenectady, NY

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Introduction

Driven by deregulation, privatization, world-wide competition and significant technological progress, the electric power business has become increasingly competitive over the last 10 years. In addition, Operation and Maintenance (O&M) expenditures have become a more important cost element because of the decrease in the two other major life-cycle cost elements. Project capital costs are nearly half of what they were 10 years ago, and fuel expenses continue to go down as new technology drives lower plant heat rates. Because the newer technology class of gas turbines has higher levels of maintenance requirements and an associated concern with new technology uncertainty, O&M expenditures are becoming a significantly larger percentage share of the total cost of electricity generation, as shown in *Figure 1*. Today, O&M expenditures can comprise 15% to 20% of the total life cycle costs, while equipment maintenance costs are approximately 10% to 15% of the total life cycle costs.

It is important to note, however, that the O&M provider has a significantly larger impact on a project than its costs; the O&M provider is the major force in driving high availability and sustained performance.

GE's Contractual Services offers creative, contractually fixed price maintenance/ operation/ availability/ performance services to create a business partnership that gives owners a competitive advantage.

Operating a power plant has always been a fairly high-risk venture. With the introduction of newer technologies, especially in the gas turbine environment, the risks can be considerable. New technology brings with it the expectation of better performance and a longer life of parts in the machines. If these assumptions are not met, the anticipated benefits from the project can quickly be erased. *Figure 2* illustrates the Discounted Cash Flow Rate of Return on Equity (DCRR) potential impacts of plausible business risk scenarios. The project Pro-Forma

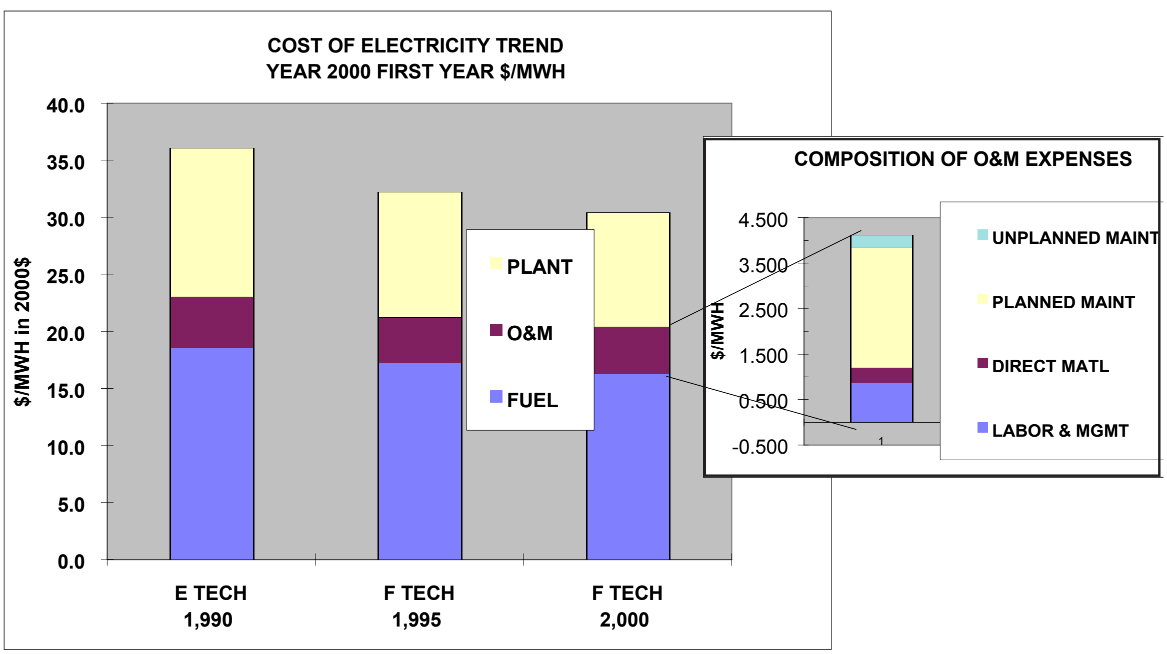

Figure 1. Cost of electricity trend

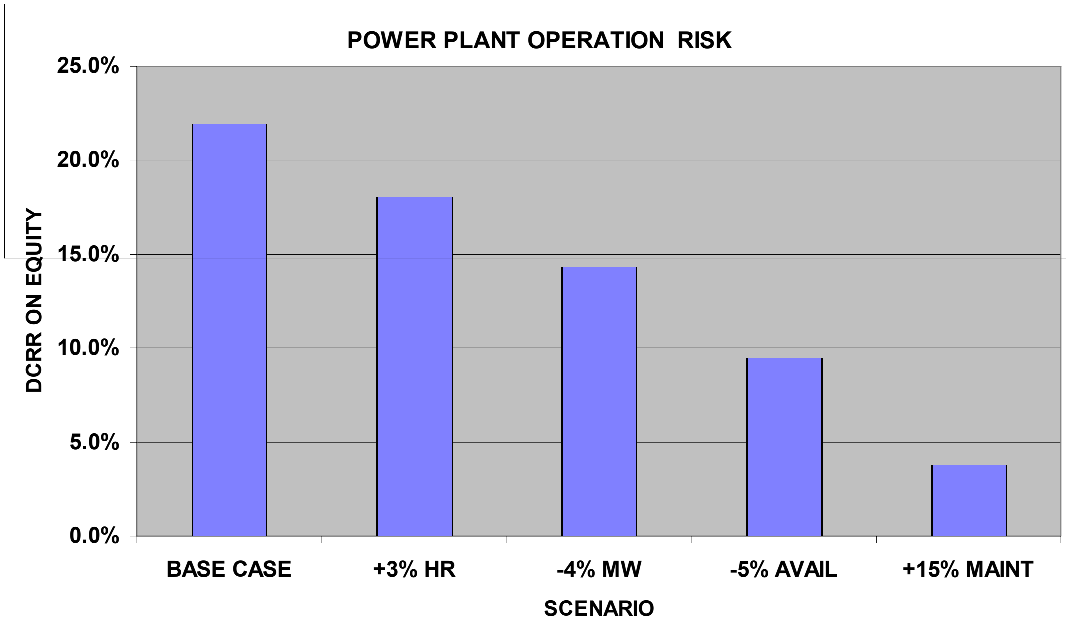

Figure 2. Business risk impact on DCRR profitability

may suggest a respectable 22% DCRR. If annual average plant heat rate degrades by 3%, the DCRR decreases to 18%. A 4% output decrease, which could be associated with the heat rate decrease, leads to the DCRR decreasing to 14%. If the availability decreases by 5%, the DCRR decreases to 9%. Finally, a 15% increase in maintenance cost because of parts life shortfalls or repairability issues, for example, leads to an anemic 3% DCRR. While these risk elements are illustrated on the downside, power plant operations always have a much larger downside risk and a smaller upside opportunity.

Risk Management

There are any number of ways to manage the risk associated with owning and operating a power plant. The two ends of the spectrum are the owner who takes on all risks with no insurance and no partners versus the owner who desires to assign nearly 100% of his risk to other parties. The former results in the lowest payment for risk management, but also leaves all of the risk with the owner. The latter results in very low risk to the owner, but at a cost that probably liquidates all of the potential profits or positive benefits of the project.

The primary goal of risk management is usually not at either end of this spectrum, but somewhere in the middle, so that the risk is held by the party who can best manage it in the most economic manner. The primary goal should be to find the optimum balance of cost, risk and value for each plant's unique set of circumstances. *Figure 3* illustrate a range of risk mitigation tools.

The traditional approach has been Transactional. The plant owner with an outage buys the parts, repairs and services as the plant requires. The overall objective is a price focus in which lowest price bids are solicited for service, repairs and new replacement parts. The vendors have little ownership interest other than obtaining the contract at the lowest cost.

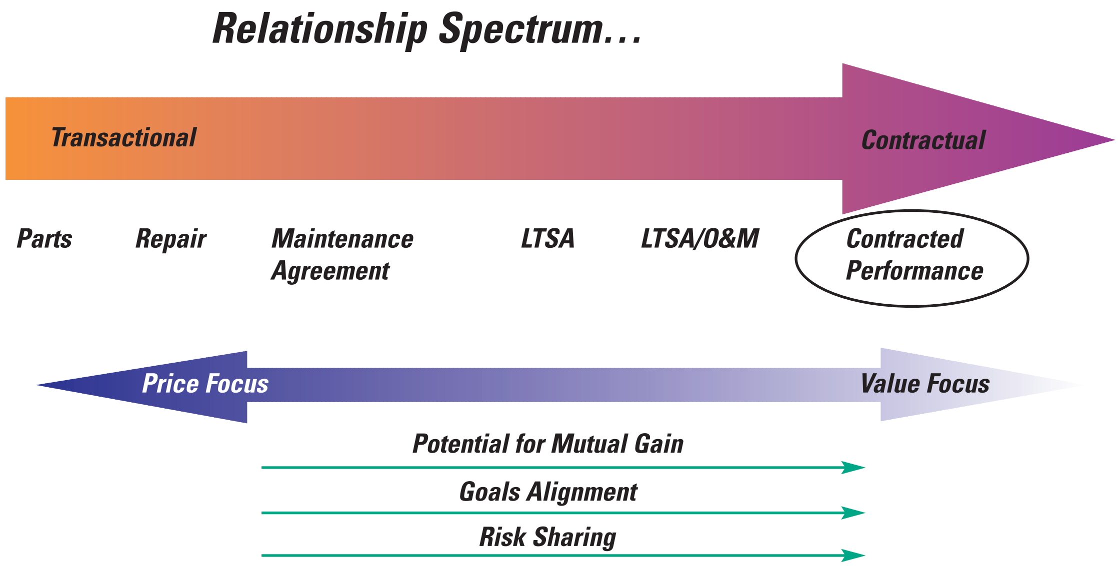

Figure 3. Risk mitigation tools

Options for providing increased value to the owner are subordinated. This Transactional relationship can be extended into a longer term transactional arrangement by execution of a Maintenance Agreement, which is typically a price discounted arrangement in exchange for a multiyear volume commitment.

The Transactional approach, however, suffers from the business goals being unaligned. When the owner has a problem, such as parts life not meeting expectations, the Transactional contractor makes a profit, and vice-versa. It is far more economically productive to have everyone working to the same goal.

The Contractual Service changes the focus from minimum price to maximum value by aligning the risk/reward goals. In this relationship, GE assumes a range of Pro-Forma responsibilities for fixed-price maintenance (Long Term Service Agreement), fixed-price O&M and performance guarantees (Contractual Performance).

Many plant owners are mitigating gas turbine and steam turbine maintenance risks by working with GE in providing Long Term Service Agreements (LTSA), as seen in *Figure 4*. The LTSA is a fixed-price maintenance contract over a three-year or longer period for planned and/or unplanned maintenance, including all parts, repairs and equipment servicing. The LTSA reduces the risks to the plant owner for future price uncertainty, technology changes and component parts life.

Many owners are also viewing the additional benefits of working with GE in providing long-term Operation and Maintenance Agreements (O&MAs) in conjunction with the LTSA. The O&MA is a fixed-price total operation and maintenance contract over a three-year period, including the equipment LTSA, operating labor, routine maintenance, plant management, plant chemicals and direct materials. The O&MA reduces the risks to the plant owner for future total plant price uncertainty, plant technology changes and equipment life.

Each of these agreements may include Contractual Performance Provisions, which provide contractual guarantees for achieving

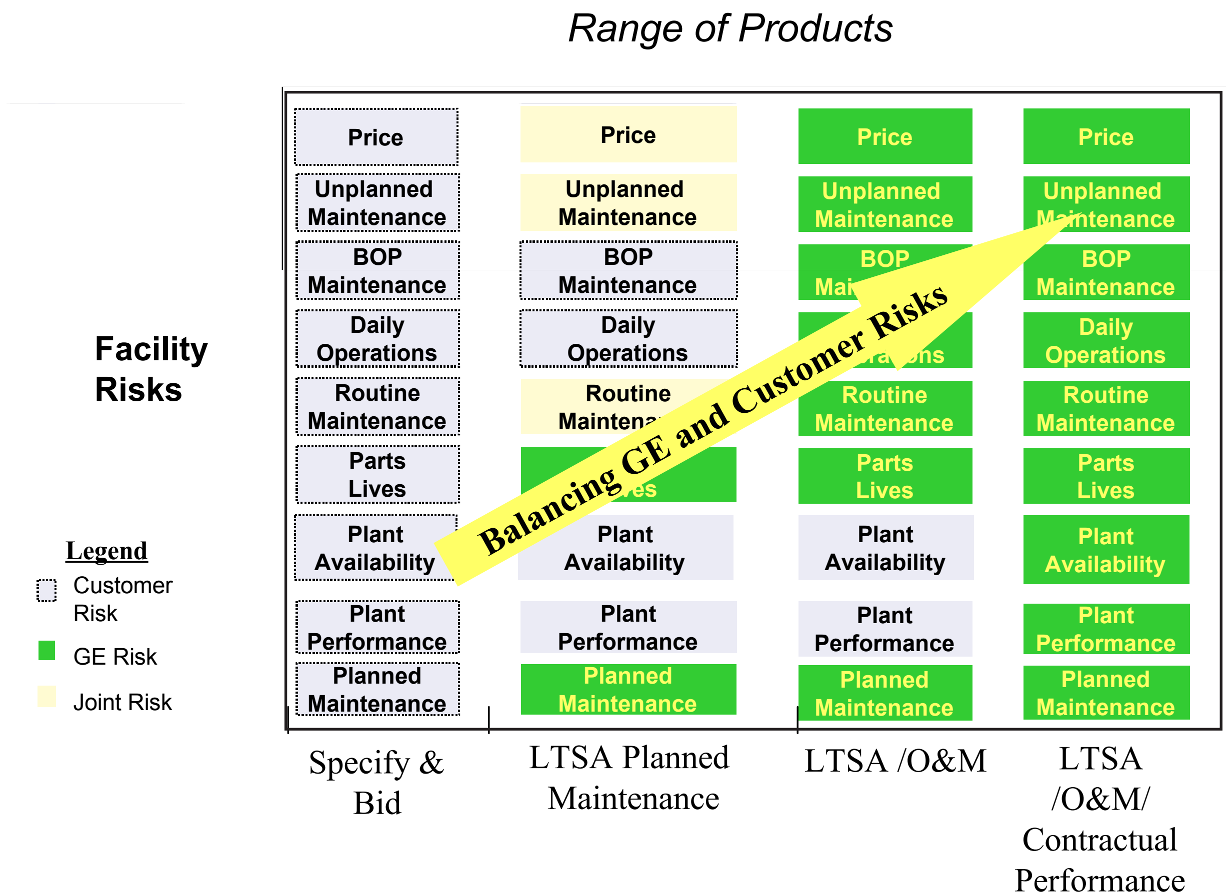

Figure 4. Range of GE products

the Pro-Forma profitability. Contractual Performance is a key influence in driving high plant operating output capability, high efficiency, high plant reliability and availability. These contractual guarantees squarely place GE in the same Risk/Reward position as the plant owner, thereby creating a partnership in working toward the same business goals.

Risk Management not only can significantly influence the operational performance of the Power Project, but it can be a major factor in financing a project. *Figure 5* illustrates the Standard and Poors financial rating of $286 million of financing for a STAG209FA merchant power plant for Sutton Bridge in the UK. The credit strength rested with the owner's ability to maintain high availability and efficiency. The LTSA/O&M/Contractual Performance agreement *"transfers virtually all operating risk to GEII and away from SBP and its bond holders."*

The Sutton Bridge agreement is only one of more than 100 units having Contractual Services Agreements as of January 2000, as illustrated in *Figure 6*. These agreements have been largely contracted during the last three years. During the next three years, GE estimates that more than 700 units will have Contractual Services Agreements.

GE Maintenance Cost Factors

The Gas Turbine maintenance cost can be 60% or more of the total O&M cost. GE maintenance recommendations are based on a

STANDARD & POOR'S

Global Project Financing

May 1997

Sutton Bridge Financing LTD.
790 MW (2) Frame 9 FA+ CC

Analysts: Peter N. Rigby, New York (1) -208-8241.
Arthur Simonson, New York (1) 212-20801991,
Michael Wilkins, London (44) 171-826-3528

Standard & Poor's has assigned its "BBB" rating to Sutton Bridge Financing Ltds $ 286 Million guaranteed secured bonds due 2022 … ***"Ultimately, SBP'S credit strength will rest with its ability to maintain a high availability and to produce electricity in the most cost-effective and efficient way possible"*** … the following strengths offset the risks: … ***"The assumption of risk was made through as Operations & Maintenance Agreement (O&M)*** whereby it (GE) is responsible for all O&M costs in return for a fixed management fee thus greatly reducing technology risk; ***The agreement … transfers virtually all operating risk to GEII and away from SBP and its bond holders"…*** "S&P considers this strategy to be a credit strength..for a facility that may eventually become a merchant plant. GE now operates [56] CCGT plants with over [9.5] GW capacity, at an average availability exceeding 95%, ***hence, it is probably in a better position than any owner-operator combination or other third-party operator to operate a CCGT*** ...In fact, GE is the largest third-party operator in the world… ***The O&M agreement further removes operations risk by requiring GEII to warrant that planned outages will last no longer than a certain number of specified days and that the maintenance cycle will follow a specified schedule. GEII is also required to warrant that the actual Heat Rate for the power plant shall not exceed the plant's contractual target Heat Rate. Remedies for failing to meet these objectives will be liquidated damages paid to SBP."***

Risk Management… Contractual Services

Figure 5. Financial risk assessment: Sutton Bridge

detailed analysis of each turbine section and the factors influencing the metallurgy and mechanical reliability of the gas turbine.

There are two key concepts in the GEII maintenance recommendation:

1. Fired hours and starts are independent parameters.
2. Combustion system and turbine hot gas components are independent.

Each of these concepts will be discussed.

Fired Hours and Starts Are Independent Parameters

For example, one key factor in turbine bucket repair/replace lives is hot gas oxidation of the bucket coatings. Another factor influencing turbine bucket repair/replacement lives is low cycle fatigue because of starts and stops. These two factors are independent and, in fact, act on different physical areas of the bucket. Fired hours also contribute to long-term material creep, which also affects repair/replacement lives of the turbine hot gas components. Because these two parameters are independent, the GE maintenance recommendations also treat each one independently. This independence not only has a firm theoretical basis but is also supported by the historical performance of the 5000 GE-technology gas turbine units. Using this approach, GE is able to schedule less frequent maintenance inspections than manufacturers who use the Equivalent Operating Hour (EOH) approach, as shown in *Figure 7.*

Worldwide Presence

Figure 6. GE Contractual Service Presence

Combustion System and Turbine Hot Gas Components Are Independent

The GE technology gas turbine combustion system is comprised of relatively thin walled systems that are influenced differently by fired hours and starts than are the turbine buckets, nozzles and outer shrouds. Consequently, GE maintenance recommendations for combustion inspections are not fixed in relation to the inspections of the hot gas section of turbine.

Turbine Long Term Service Cost is a function of many variables, including technology, unit size, covered scope and contractual flexibility. *Figure 8* illustrates typical cost trends for several GE gas turbine models in a STAG 20x configuration.

For the same size unit, the F technology maintenance cost is higher. For example, the 7EA and 6FA are about the same size, but the 6FA maintenance cost is about 50% higher. This is because of the increased cost of the high technology parts needed to implement the higher firing temperature F technology units.

There is an economy of size in which doubling unit sizes does not lead to a doubling of maintenance cost dollars. The economy of size is greatest for the smaller sizes. The economy of size for the 6B to 7EA is approximately a 50% economy of maintenance cost for a doubling of size, while the economy for the 7EA to 9EA is only 15% for a 45% increase in size.

The covered scope is flexible to meet owner

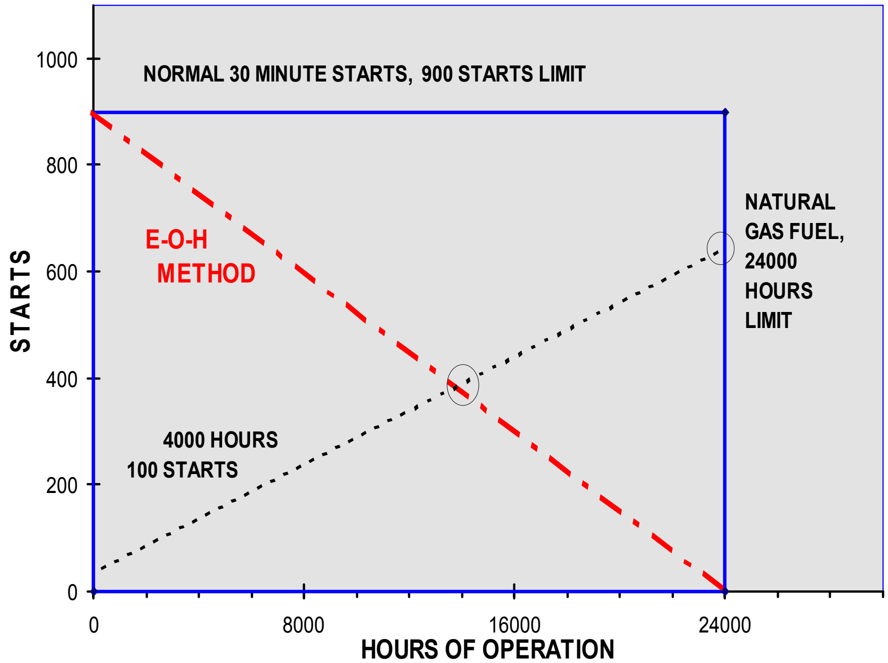

Figure 7. MS7001FA hot gas maintenance interval

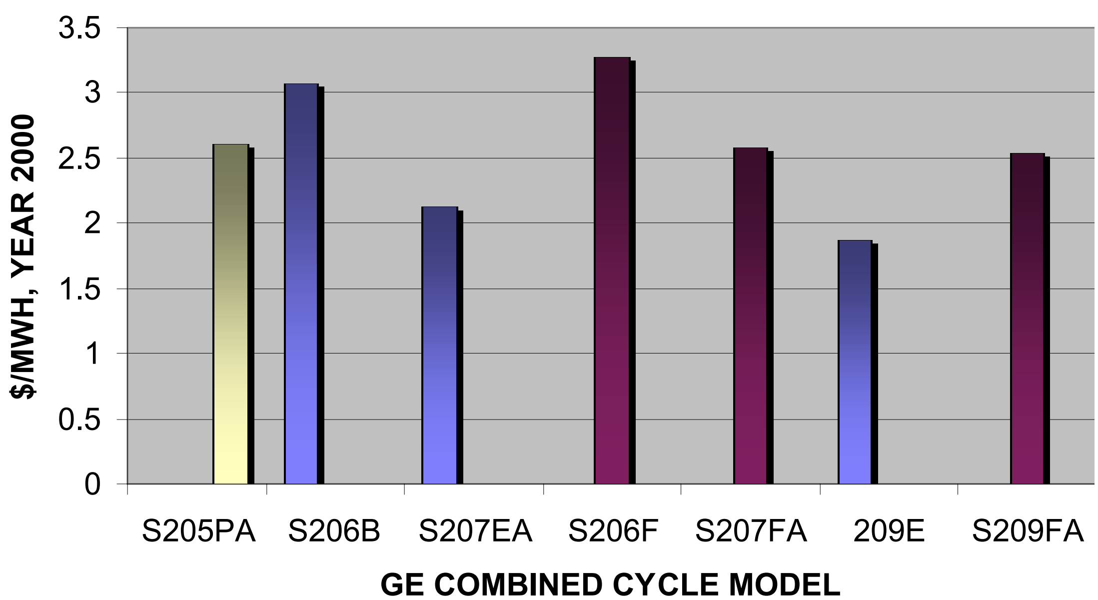

Figure 8. Long term service cost trends

risk/reward tradeoffs. Covered scope can include planned maintenance only on the turbines, can include planned and unplanned coverage and can include or exclude low risk/high impact scope, such as turbine rotors and casings.

Contractual flexibility influences the degree to which GE can implement productivity improvements. Some owners insist that serialized parts must remain within their fleet of units. Other owners permit GE to use parts throughout the Contractual Services fleet. This flexibility permits economies through lower parts inventories, allows parts to be used sooner and replaced by new technology parts earlier, and lowers repair costs by removing parts from critical repair cycle times. Other contractual flexibilities are present that can similarly lead to productivity improvements.

Merchant Plant Pricing

LTSA/O&M pricing is structured to flexibly meet owner needs. When and how the owner makes money (such as peak summer sales, off-peak curtailments, maximum summer availability, frequent start-ups/shutdowns or high-cost winter natural gas) is aligned with the LTSA/O&M pricing. This drives the GE Contractual Services behavior to mirror owner behavior. In this way, the LTSA contractors and owners have a common interest in which each is maximizing profitability, both their own and each others'. Pricing flexibly incorporates $/fired hour and $/MWH basis. Where circumstances require, pricing can also include a number of provisions, such as On-Peak/Off-Peak $/MWH and Power Augmentation Hours.

Most combined-cycle power plants being constructed today will operate in a competitive power market, either today or in the near future. Power plants may be dispatched as a baseload 8000 hour/25 start per year plant when initially placed into service. As newer technology plants are added, however, existing power plants may be relegated to a cycling role. For example, one O&MA "E" technology combined cycle plant that operated for 8000 hours/25 starts during the mid 1990s is now operating at 7000 hours/75 starts during the late 1990s and foresees its future role as a 5000 hour/125 start cycling plant. Over a 10- to 20-year period, an "F" technology combined cycle plant may evolve from 8000 hours/25 starts per year to 5000 hours/150 starts per year. In some countries and regions of the world, hydroelectric plants are a dominant provider of electricity. In this case, during dry water years the combined cycle power plant may be base loaded to 8000 hours/15 starts, while during wet water years the plant may be loaded to 4000 hours/150 starts.

The contract pricing range is established in discussions with the owner and may be typically valid for factored starts of 50 to 300 starts per year and for factored fired hours from 3000 per year to 8000 factored hours per year, as shown in *Figure 9*. Because of GE's maintenance cost factors (*see Figure 7*), the pricing within the Hours Limited Operation Region are essentially driven by fired hours, and starts has only a very small influence. For operation in the Starts Limited Operation Region, the pricing is largely driven by starts; hours has only a very small influence.

This Merchant Pricing algorithm has been widely used in many recent Contractual Services Agreements.

Contractual Performance

The objective of Contractual Performance is to align the operational goals of the owner with GE in a manner that provides business incentives to enhance power plant productivity. The LTSA/O&MA can achieve this by using the latest technology replacement parts, implementing advanced repair and service technology to assure correct parts fit with minimum leakages, using state-of-the-art preventive maintenance

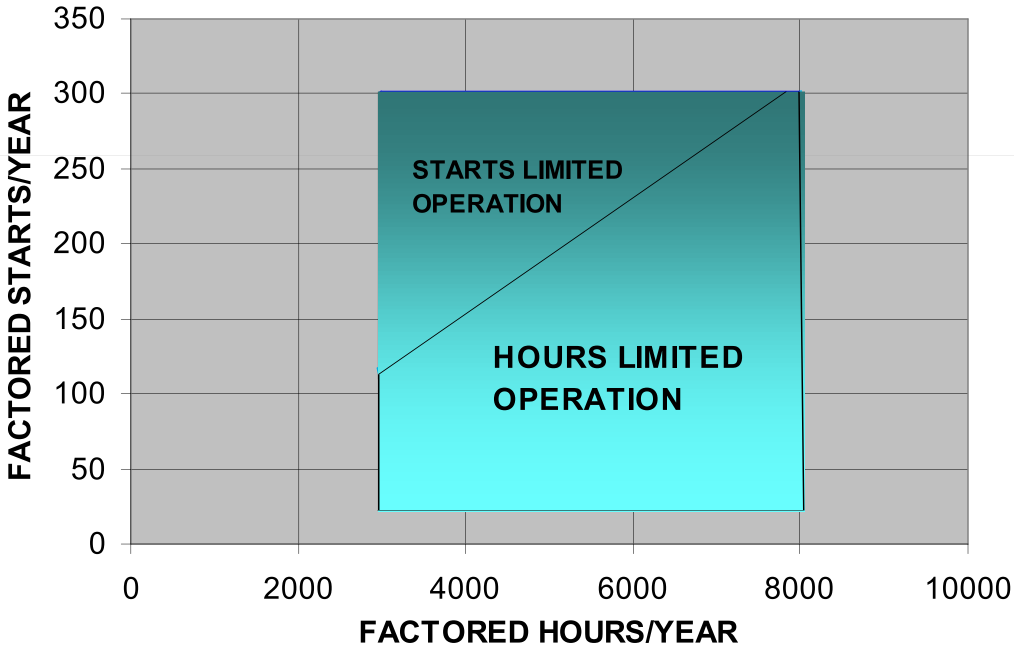

Figure 9. Merchant pricing application

systems and employing GE technical resources to quickly provide technical solutions. In addition, the LTSA/O&MA can make investments in new technology to further enhance the plant performance.

The LTSA, however, does not have control over the plant's day-to-day operation; it can only control the performance recovery during the planned outage events. Thus, the LTSA contractor performance incentive is typically based on performance recovery at the key gas turbine inspections. However, an O&MA has daily control of plant operation and therefore can guarantee daily performance.

The gas turbine performance degrades from new and clean performance because of many factors, including compressor fouling, increased leakages and airfoil surface finish changes. Plant operation can also have a significant impact on the performance degradation. Off-line and on-line compressor water washes, inlet filter replacements, frequency of starts/stops and plant chemistry can be major factors.

Based on the experience accumulated from testing gas turbines and combined cycle plants, GE has constructed Performance Degradation Curves. The Performance Degradation is generally evaluated based on the "as tested" performance as the plant is turned over from the EPC contractor to the owner at commercial operation. *Figure 10* illustrates the average GE data trend after an off-line compressor water wash and based on daily on-line water wash; one off-line wash per month; filter replacements every two years; a clean atmospheric operating environment free from significant dust, petroleum and chemical laden particulates; and low humidity. The graph is based on Hot Gas Path Inspections at 24,000 hours and Major Inspections at 48,000 hours.

Figure 10 indicates that the average degradation increases to approximately 5% in power output and 2.5% in heat rate during the first 24,000 hours of operation, typically three years for a baseload plant, at which time a Hot Gas Path Inspection would normally be performed. At the Major Inspection, buckets, nozzles, shrouds

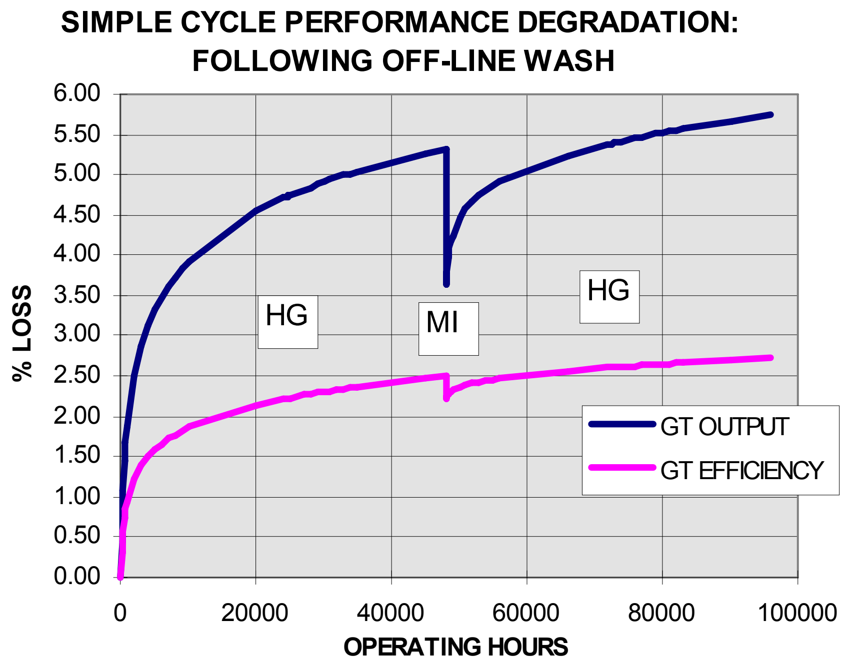

Figure 10. GE Performance degradation curve

and packing seals are repaired/replaced, restoring some of the performance degradation. In addition, the compressor casing is removed, and the compressor blading is cleaned and scoured. The compressor scouring significantly restores compressor performance, which has a large positive influence on the entire gas turbine and combined cycle plant degradation. While *Figure 10* illustrates average performance, individual units may perform better or poorer than the average.

While *Figure 10* illustrates the GE fleet average, at one large "F" Technology plant with an LTSA the degradation has been significantly less. The degradation is measured in this case relative to the "new unit design guarantee" and includes the effects of new unit performance margin. The plant began operation in late 1994, and each gas turbine has accumulated more than 24,000 hours and has had Combustion Inspections and one Hot Gas Inspection along with planned turbine rotor changeouts. *Figure 11* presents the gas turbine degradation compared to the design guarantee. These LTSA units have averaged approximately 2% MW output degradation and 1% heat rate degradation during their first three years of operation. Online compressor water washes are conducted every two days, and typically two or three offline water washes per year are performed. The compressors have been scoured during this time period during hot gas inspections, rotor changeouts and compressor rub inspections, significantly reducing deterioration.

Another form of Contractual Performance is Availability and Reliability. The purpose is to provide business incentives to the LTSA/O&MA to enhance power plant availability. The LTSA/O&MA can achieve this by minimizing outage duration by project managing the outages with high-quality outage service management, good spare parts availability, specialized labor skill and quality, and specialized tooling, and employing best practices from the GE fleet. Reliability is enhanced by high-quality staff training, advanced preventive management sys-

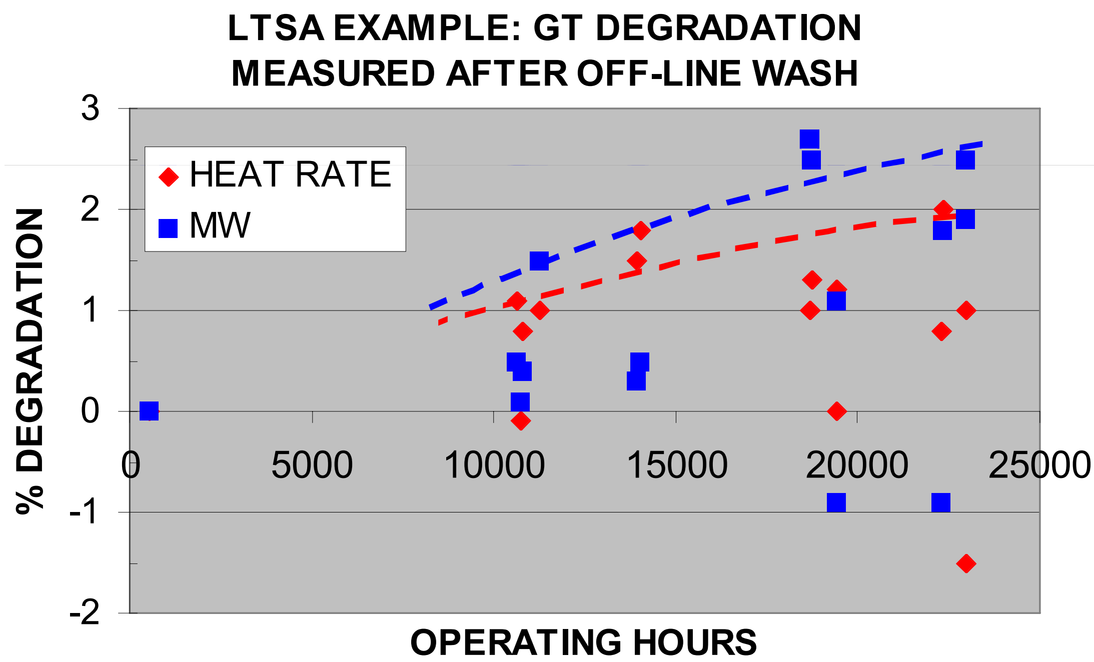

Figure 11. "F" Technology performance degradation example

tems, parts inventory and GEII fleet feedback. The LTSA site director and O&MA plant management are key resources in driving high availability.

Figure 12 presents several availability statistics for baseload 7EA and 7FA gas turbines and combined-cycle power plants, as collected by Strategic Power Systems, Inc. Presented is the gas turbine Forced Outage Factor, which includes only the immediate shutdowns of the unit prior to the next weekend, per the IEEE/ANSI and North-American Electric Reliability Council definitions. Also shown is the total gas turbine Unplanned Outage Factor, which includes the immediate forced shutdowns plus the unplanned shutdowns that were deferrable past the next weekend. The total gas turbine unavailability is also shown, which includes unplanned plus the planned inspections. Finally, the Total Combined Cycle Unavailability is shown, including unavailability due to the gas turbine, heat recovery steam generator, steam turbine-generator and all plant auxiliaries.

The GEII MS7000E/EA gas turbine, introduced to the marketplace in the early 1980s as an evolutionary product of the Frame 7 Series, has become an industry leader in reliability and availability. The 7F was introduced in 1989 and is still in a maturing reliability phase. Also, the 7FA is a different frame size and design than the 7EA, as is the availability performance. For example, a Combustion Inspection on a 7EA unit requires about four days, while the larger 7F unit requires about seven days.

The baseload 7EA gas turbines have been averaging 95%+ availability with 98%+ reliability, and the combined-cycle plants have been averaging 94%+ availability. The 7F gas turbines have been averaging 93% availability with 96.5% reliability, and the combined cycle plants have averaged 91% availability.

The availability at one GE LTSA "F" technology power plant has been 94%+ during the last five-year period, several points better than the GE Fleet Average. The composition of the unavailability causes is shown in *Figure 13*. Planned outages accounted for 60% of the unavailable time,

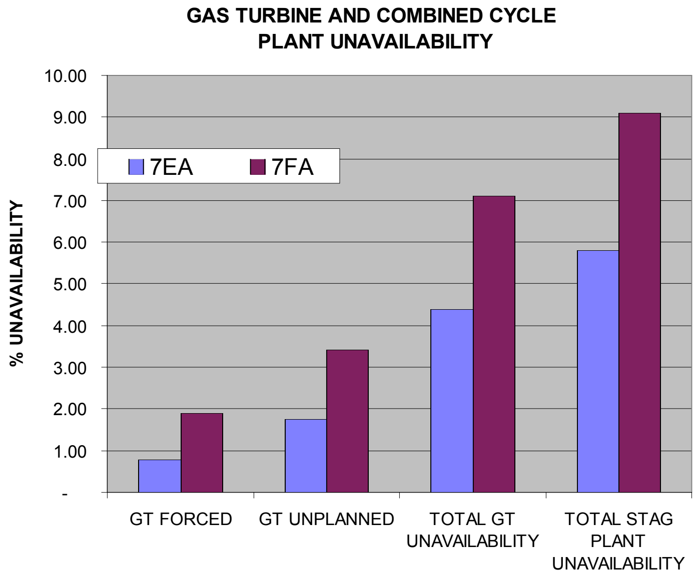

Figure 12. Fleet availability performance

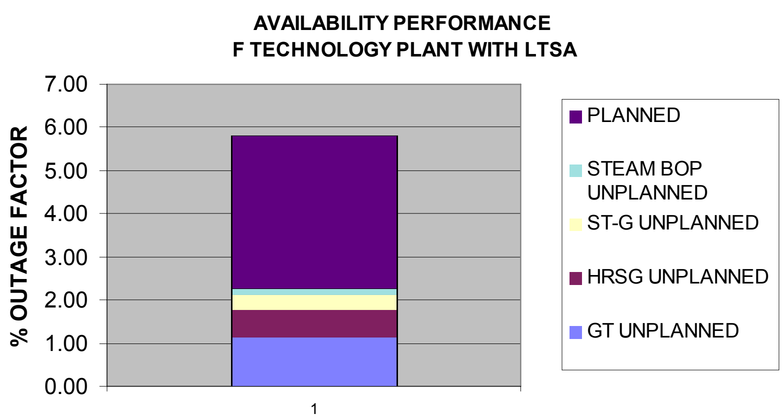

Figure 13. One example LTSA plant availability performance

with gas turbine unplanned outages contributing 20% of the unavailable time.

High Availability performance of the plant during the Summer Peak Demand Period provides significantly greater value to the plant owner than availability during the Spring/ Autumn low demand periods. As a result, the Contractual Performance Availability Guarantee is structured to provide significant disincentive for unavailability during these Peak Periods.

With many plants operating in a merchant market environment, the sales price can have large swings. *Figure 14* illustrates the trend for the CalPx market during last year. Power rates can peak above $100/MWH for several hundreds of hours per year. For many owners, being available on-line to serve this opportunity is essential.

The hourly Spark Spread is generally of greater interest to the owner than is the Energy Sales Rate of *Figure 14*. The hourly Spark Spread is

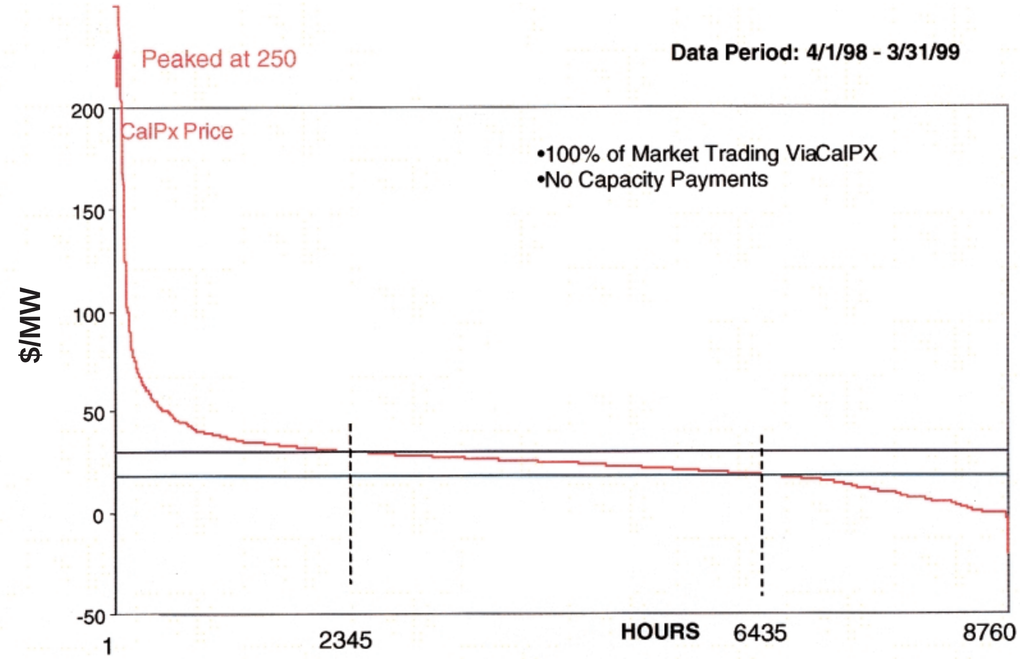

Figure 14. California Power Exchange energy sales rate distribution

the net Operating Profit from operating the plant and is equal to the Revenue from Power Sales less the cost of variable fuel less the cost of variable maintenance.

One measure that Merchant Plant owners have found useful is the Economics Weighted Availability. The Economics Weighted Availability is defined as the average hourly Availability weighted by the hourly Operating Profit. This measure evaluates the true economic value of availability to the owner. The Contractual Performance Availability Guarantee is focused toward maximizing the Economics Weighted Availability.

The Economics Weighted Availability can be maximized in several ways by deferring as much unplanned maintenance to periods of low Spark Spread, such as weekends and off-season months, and by utilizing around-the-clock maintenance work, the most productive service teams and technology tooling to reduce the outage time duration, and advanced technology parts that increase the time between outages.

New Technology Tools

Contractual Services has placed GEII in a new business with a rapidly growing number of units under LTSA/O&MA contract. As a result, a new emphasis is being placed on developing new technology tools to support this business. The new technology tools are aimed at improving reliability and availability, extending parts lives and enhancing plant performance.

Monitoring and Diagnostics

The introduction of newer high performance technologies and the desire for very high reliability and availability has led GEII to use the latest information technologies and install Monitoring and Diagnostic (M&D) Systems on its O&M and LTSA plants for GE's use in improving performance. *Figure 15* illustrates the M&D concept.

The GEII M&D system is a diagnostic tool that continuously monitors the internal performance of the turbine to check for performance

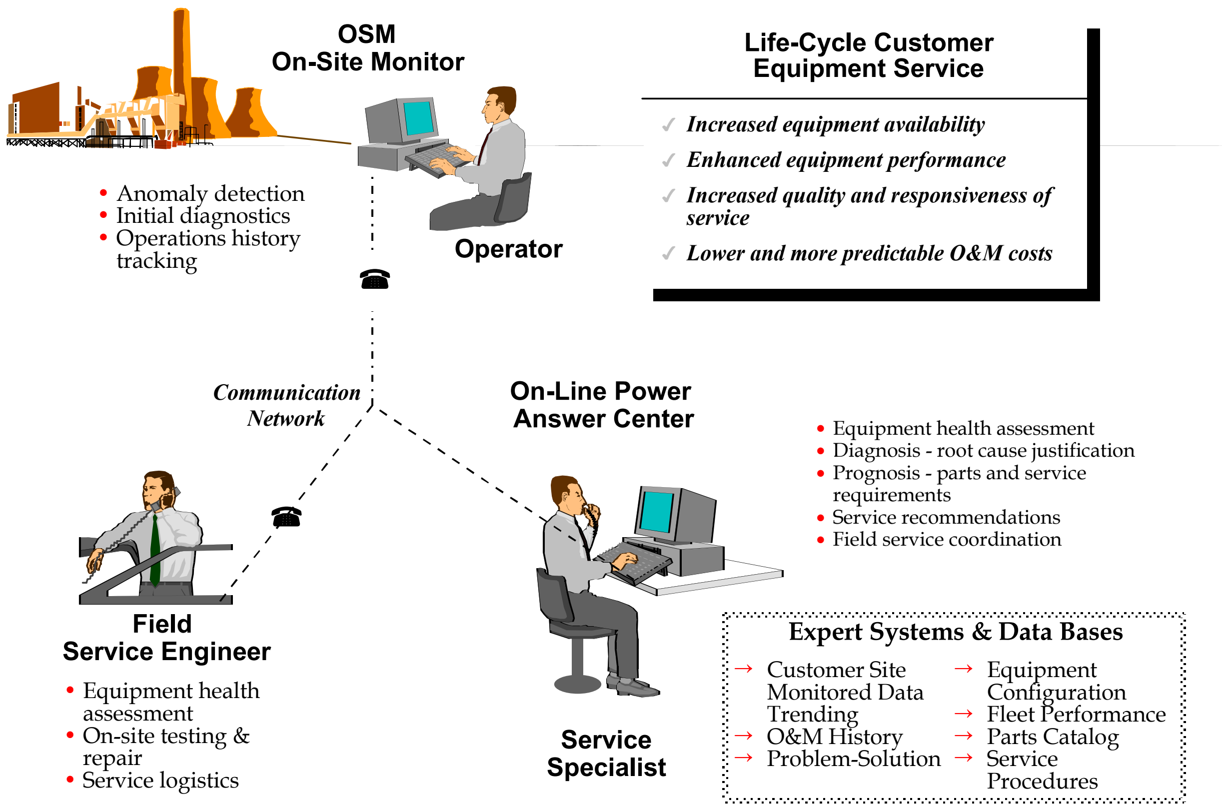

Figure 15. GEII M&D system

anomalies. The M&D system has access to the hundreds of turbine instrumentation sensors, such as turbine exhaust temperatures, wheel space temperatures, bearing vibrations, fuel flow and power output. The On-Site Monitor, which compares actual unit performance with baseline predictions, provides the first level of anomaly detection and notification. The On-Site Monitor communicates to the engineers at the GE Power Answer Center, which is staffed 24 hours per day, seven days per week. Located in Atlanta, GA., the Power Answer Center reviews the overall turbine data on a daily periodic basis and considers all anomaly events. Experience has shown that small anomalies may be detected several days before the anomaly becomes large enough to cause a trip of the unit.

Figure 16 illustrates an example of how the M&D system detects combustion system side seal leaks. The exhaust thermocouples show a marked cold spot in the area where a side seal may have fallen out. After the side seal falls out, compressor discharge air can enter into the first stage turbine nozzle segment and lead to a cooler gas turbine temperature.

Plant Performance Monitoring

The GE Plant Performance Monitor System is an on-line power plant management software tool designed to assist the Contractual Services team in maximizing plant performance and owner operating income.

The system's primary duty is to daily compare the current plant performance with the base-

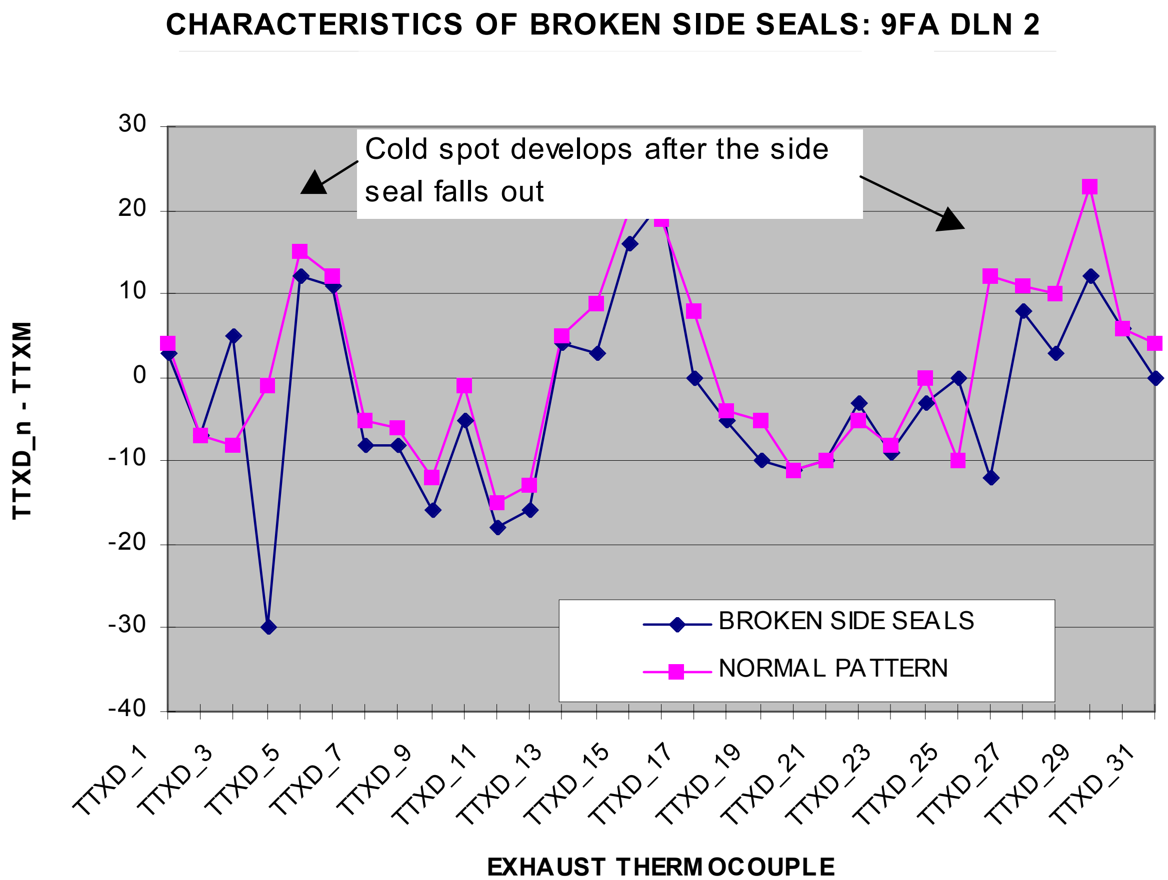

Figure 16. M&D system example

line plant, generally the new and clean plant performance at the guaranteed conditions. The software reads the plant Distributed Control System (DCS) parameters based on the current operating environmental parameters, including ambient temperature, pressure, humidity and steam to process, and performs an analysis, which predicts how the plant would be operating at baseline conditions. The system contrasts the corrected actual plant performance to baseline performance and provides information on if, how much and in what way the plant is deviating from baseline performance. Information from this comparison leads to corrective actions that can save up to hundreds of thousands of dollars per year. *Figure 17* illustrates a typical Compressor Wash Monitoring to determine the most economic date to conduct the next offline Water Wash.

Parts Database

With an increasing number of units under Contractual Services contract, keeping track of the hundreds of parts in each unit is both a significant responsibility and a significant opportunity for sharing parts among the fleet of LTSA/O&M units. In response, GEII is populating a Parts Database, which keeps track of each serialized hot gas and combustion system part in the gas turbine. Each part has its exposure characteristics tracked as it moves from one operating year to the next, including insertion date, fired hours, starts, trips, fuels, current unit name and part location within the unit. Also attached to each part is a data base pointer to the shop inspection and repair reports. *Figure 18* illustrates a part condition repair report for a combustion liner.

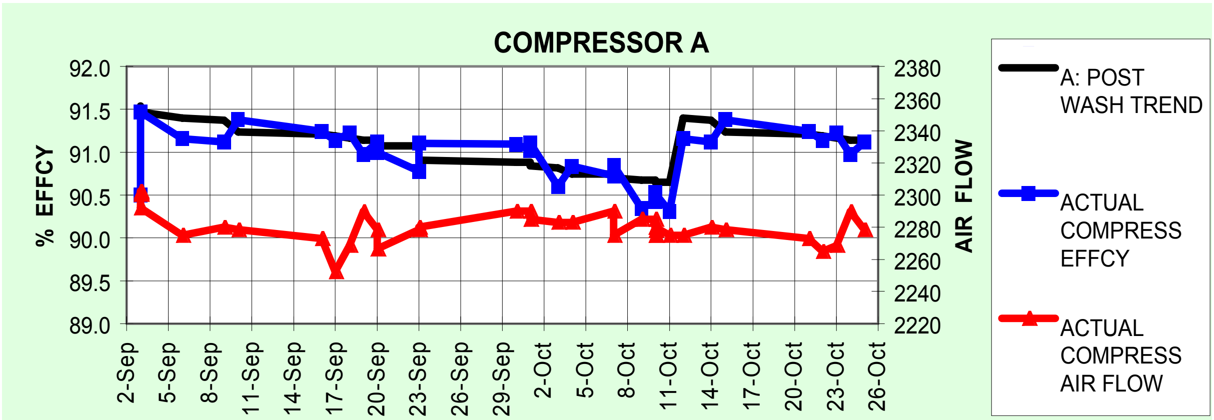

Figure 17. Compressor wash optimization

5/22/97	108E4249G001	Refurbished	296300	2	15831		94	35

Area	Condition	Severity	Measurement	Units	Action	Repair Shop
Body	Cracked	Light	1	in	Repaired	Houston
TBC Coating	Coating Loss	Moderate			Replaced	Houston
Spring Seal	Wear	Moderate			Replaced	Houston
Body	Bulge	Light			Repaired	Houston
CrossFire Tube Collar #1	Wear	Light			Repaired	Houston
CrossFire Tube Collar #2	Wear	Light			Repaired	Houston

Figure 18. Shop repair condition report on a combustion liner

New Products Introduction

Many new product development programs are aimed at supporting the Contractual Services business including advanced extendor combustion systems to eliminate one or more combustion inspections, novel ways to clean the compressor and reduce performance degradation, new Non-Destructive inspection methods to extend parts life, and improved rejuvenation procedures to extend parts life.

Conclusions

Operation and Maintenance expenditures can comprise 15% to 20% of the total life cycle costs.

There is a growing trend of many plant operators to help control turbine maintenance and plant operational expenses by having a Long Term Service Agreement and/or Operation and Maintenance Agreement with the Original Equipment Manufacturer. The OEM is in a unique position to best manage the technology uncertainties and associated cost risks. Not all LTSAs/O&MAs are alike, however, and it is important to have a full understanding of the agreement scope.

The LTSA is a fixed-price maintenance contract over a three-year or longer period for planned and/or unplanned maintenance, including all parts, repairs and servicing of the equipment. The LTSA reduces the risks to the plant owner for future price uncertainty, technology changes and component parts life.

The O&MA is a fixed-price total Operation and

Maintenance contract over a three-year period, including the equipment LTSA, operating labor, routine maintenance, plant management, plant chemicals and direct materials. The O&MA reduces the risks to the plant owner for future total plant price uncertainty, plant technology changes and equipment life.

Each of these agreements may include Contractual Performance Provisions, which provide contractual guarantees for achieving the Pro-Forma profitability. Contractual Performance is a key influence in driving high plant operating output capability, high efficiency, high plant reliability and availability. These contractual guarantees squarely place GE in the same Risk/Reward position as the plant owner, thereby creating a partnership that is working toward the same business goals.

Contractual Services has a large emphasis on developing new technology tools to support this business. The new technology tools are aimed at improving reliability and availability, extending parts lives and enhancing plant performance.

In conclusion, Contractual Services is bringing these products and service to owners to change the focus from minimum price to maximum value by aligning the risk/reward goals. GE's Contractual Services offers creative, contractually fixed price maintenance/ operation/ availability/ performance services to fuel this business partnership and create owners competitive advantage.

List of Figures