Greater summer power demand and more advanced gas turbines lead to an increased need for turbine inlet chilling. Photo courtesy of TAS, Ltd.

A Perspective on the U.S. Electric Power Industry

PROBLEMS, SOLUTIONS & NEEDS

By Craig M. Hurlbert

We all know that the U.S. electric power industry is one of the best in the world. However, it's far from perfect in that there are several structural problems which must be addressed and fixed as soon as possible. From the perspective of the electric power consumers and the environment, I believe the U.S. power industry problems include the following:

- ✗ Increasing grid instability
- ✗ High electricity cost during peak periods
- ✗ High environmental emissions during hot weather

The lack of grid reliability generally occurs during hot weather when we need electric power the most. Some of the reliability problems stem from the aging grid infrastructure and some from the lack of sufficient supply to meet demand from the grid-connected loads.

As we all know, the electric energy and demand charges are high during peak periods. Sometimes these charges are as much as five times as those during off-peak periods, and it is not because the power producers are gouging the consumers. The on-peak prices are influenced by two major factors: demand and supply, and the types of power plants brought on stream to meet peak loads. Many of these peaking plants have low energy efficiencies that increase the cost of producing electric power. In addition, when the weather becomes hot, the energy efficiency decreases and the cost of producing electric power increases for all power plants that use combustion turbines.

Environmental emissions increase during hot weather for two reasons: decreased energy efficiency of all combustion turbines, and start-up of older, dirtier, and inefficient peaking plants. Operating these power plants at low efficiencies not only increases environmental emissions, they also consume more fuel (natural gas, fuel oil, or diesel) per unit of electric energy produced. Over the last 20 years, most of the new power plants brought on stream in the U.S. use natural gas (Figure 1), and electric generation represents the highest demand sector for growth for natural gas (Figure 2). Natural gas demand for power generation increases during summer (Figure 3). We all have seen the prices of natural gas peak much higher than ever before, while the *average* price of natural gas also seems to settle at a higher level than before (Figure 4). U.S. production of natural gas is not sufficient to meet demand; we now must import LNG to supplement it. Whether the combustion turbines use natural gas or oil, it is imperative that we not continue to operate our power systems at low efficiencies, particularly when much of the fuel source originates in an unstable and hostile region of the world.

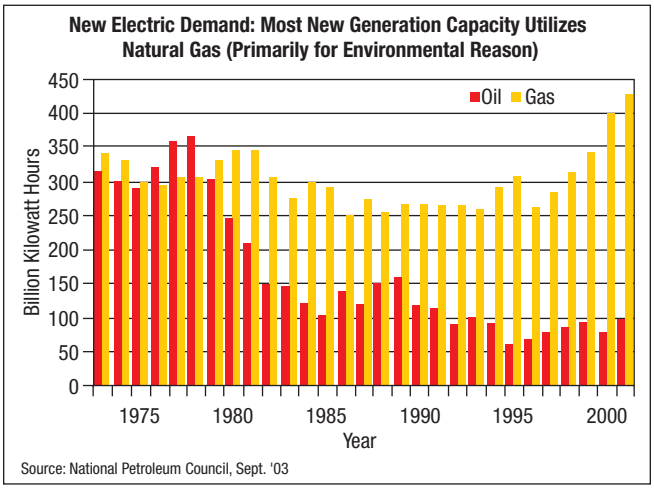

Figure 1

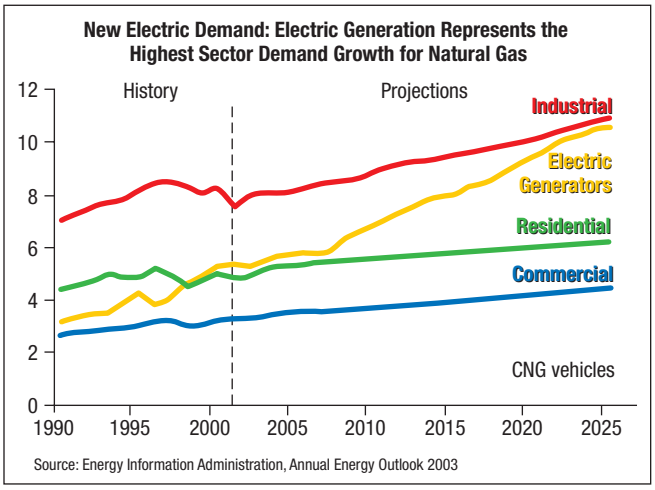

Figure 2

Solutions

We need a multi-faceted approach for solving the problems within the power industry. This approach should include the following components:

- ✗ Modernizing grid infrastructure
- ✗ Demand side management
- ✗ Distributed generation
- ✗ Power augmentation

We cannot afford to continue with the antiquated grid infrastructure - it must be modernized. Without it, all other approaches for improving grid reliability will never be adequate. **Modernizing grid infrastructure** is going to require a hefty budget from industry *and* government. It is not a near-term solution; it will require significant time. Nonetheless, improving the grid infrastructure alone will not improve grid reliability.

We should bring **demand side management** back to the forefront. We should explore with more vigor the ways to shift power usage from day to night. It is time for the concept of thermal energy storage (TES) to garner some serious consideration from the electricity demand side. TES allows electricity users to shift power demand from day to night; yet inexplicably it is not a serious part of the demand side management dialog today. Of course, we should continue to develop more energy-efficient light bulbs and refrigeration systems, etc. However, demand side management alone does not completely bridge the gap between power supply and demand.

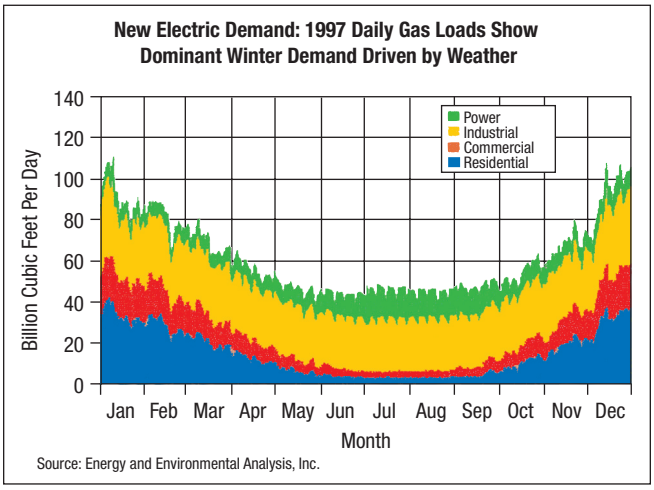

Figure 3

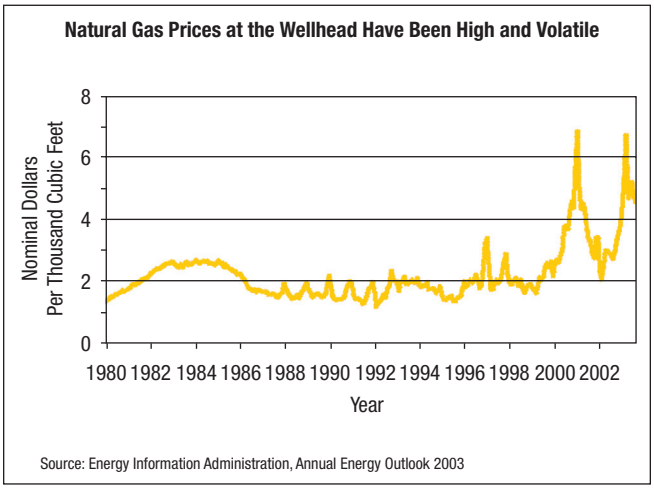

Figure 4

Distributed generation can reduce load on the grid and therefore help improve grid reliability. The U.S. Combined Heat and Power Association (USCHPA) is making commendable efforts for disseminating information about the benefits of distributed generation including combined heat and power. The USCHPA is a private, non-profit association, formed in 1999 to promote the merits of CHP and to achieve public policy support. It is attempting to create a regulatory, institutional, and market environment that fosters the use of clean, efficient CHP as a major source of electric power and thermal energy in the U.S. The goal of the USCHPA is to increase CHP generation capacity in the U.S. from 46 GW in 1998, to 92 GW by 2010. The traditional capital cost required for CHP systems is usually higher than that for centralized generation. New packaged CHP systems are under development with industry and government funding; these systems are energy efficient, will help improve grid reliability, and will conserve fuel resources.

Of these four solutions, **Power Augmentation** could have the biggest potential impact in the immediate term. Power augmentation is an approach that allows combustion turbine (CT) power plants to continue to produce their rated power capacities—or *more* than the rated capacities— especially during hot weather conditions. Turbine Inlet Cooling (TIC) has been successfully used at many power plants across the world for power augmentation. While the TIC technologies in use today are at least 20 years old, power industry executives and planners remain alarmingly uneducated on this proven option. TIC increases energy efficiencies of CT power plants, is a well-proven technology, and serves as a lower-cost option compared to adding peaking plants. In addition, it can be easily retrofitted to existing power plants or incorporated into the design of new plants.

Overall, TIC helps maximize the value of existing and new power generation assets, and is responsive to all three power industry problems: grid reliability, cost of producing electricity, and environmental emissions. Some believe that as a direct result of the proliferation of CT based power generation, TIC is the most important breakthrough in the last 25 years in the power generation industry. According to a research study by independent consultant Frost and Sullivan, TIC should be at least a $1 billion per year opportunity based on its value proposition. The Turbine Inlet Cooling Association (TICA) promotes the development and exchange of knowledge related to TIC for enhancing power generation worldwide.

Don't you think we should give at least equal weight to maximizing the potential of our existing power plants as we do to building new ones? Isn't it sensible to make what we have more energy efficient? It does make sense, especially when TIC technology costs, in most cases, a fraction of a new plant, is more environmentally friendly, and has virtually no negative impact (and some positive) on the existing transmission system.

Needs

Even though TIC provides a simple, proven solution, it is not yet on the radar screen. The country needs leaders with authority in industry

and government to rise and start looking into the electric power problems and the potential benefits offered by TIC.

Remember when Congress passed the Public Utility Regulatory Policy Act (PURPA) in the late 1970s? It did so with a strong belief—and rightfully so in hindsight—that consumers would benefit greatly from competition. A savvy power industry historian could argue that PURPA actually led to the merchant plant debacle and therefore was a failure. The counter to that is yes, PURPA blazed that now infamous trail, but utilities today are much more competitive-minded than they were in the mid-1960s and 1970s, and as such consumers are better off. But the real question is, if PURPA, and the threat of a competitive deregulated market, had not been created, would utilities have changed their mindset by themselves? The answer to this question is a resounding, "No!"

History illustrates that the government has a role in helping the energy industry make necessary structural changes to look out for the good of the consumer and the environment. Now that we may be slipping back toward the utility command-and-control mindset of old, away from the IPP model, the time has come for another structural shift. It is time for the *next* PURPA legislation. It is time for Congress to step up and take a lead on behalf of the ratepayers in the electric power industry.

If we are to maintain our competitive advantage as a country, then we must keep our energy costs as low as possible. We must protect the environment to the greatest extent possible, and quickly escalate the issue to higher levels within the industry and government where real change can be created. Why is power augmentation not a topic of big discussion inside the seemingly ever-stalled Energy Bill? Our legislators, aside from thinking about long-term solutions, should also look into sound ideas with immediate impact in securing our future. Power augmentation via TIC is a low hanging fruit with a positive economic and environmental impact—something both sides of the House should be able to agree upon. History shows that this type of change only happens when Congress steps in and makes change mandatory. It is time for power augmentation to make its way to the forefront.

As an industry, we need to strongly encourage Congress to break free from the lobbying quagmire that has become the Energy Bill, and get serious about positive structural changes in the electricity industry. Meanwhile, individual power plant developers, owners, and operators should already be aggressively exploring and implementing economic retrofits of power augmentation, including TIC.

While the technical problems facing our industry are serious, there are realistic solutions for these problems that benefit both the ratepayers and the environment. However, our industry today is suffering from something much more serious, something with no technical solution. We are in the midst of a serious industry wide "leadership vacuum." This vacuum has placed us in a state of collective inaction on any matter of importance. I feel uncomfortable saying this, but I do not think our industry can do this alone – I think we must have interference from Congress, and the Energy Bill would be a great vehicle for this "intervention."

It is time for leaders to emerge in the U.S. power industry!

Figures 1-4 were derived from the following paper presentation: "Natural Gas Markets Update for the Ethanol Industry: Identifying Market Fundamentals and Managing Price Risk."

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