TRANSITION TO A DIGITAL SOCIETY

AN ANTIQUATED SYSTEM HOLDS US BACK

BY PETER M. CURTIS

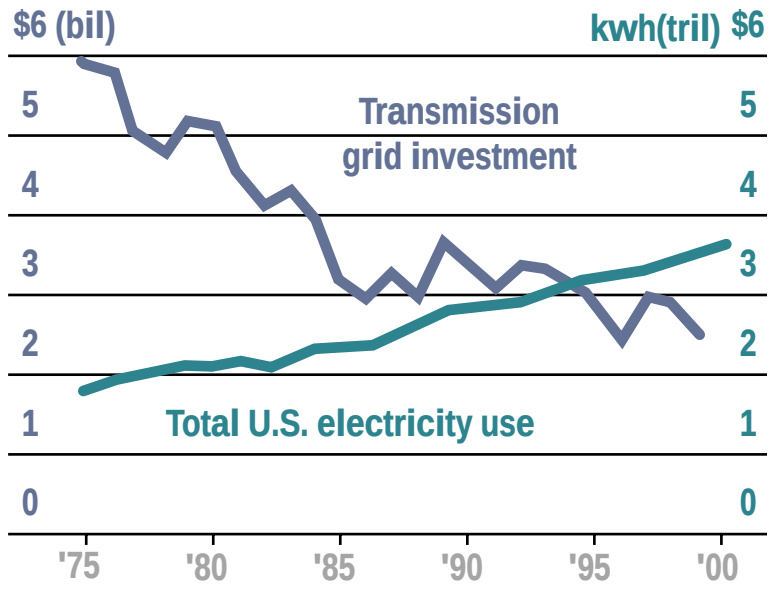

Figure 1. Transmission grid investment vs. energy consumption *Source: Edison Electric Institute; U.S. Department of Energy.*

Until recently the U.S. has largely ignored the shortcomings of its increasingly antiquated transmission system. The August 14th blackout in the northeast forcefully brought this system and the need for infrastructure upgrades to the attention of policy-makers and end users alike. Today's electrical distribution system was established over 50 years ago to transmit power to a limited number of analog devices. For a variety of reasons, investment in power generation and transmission and distribution has not kept pace with escalating demands for reliable, conditioned power required by today's digital world (see figure 1). Modern-day facility owners and managers face the increasingly complex challenge of operating digital devices on power provided by a transmission and distribution system designed for analog equipment. Poor power quality, power distribution disruptions, electrical grid malfunctions, and environmental disturbances, such as lightning or even electric static discharge (ESD) can cause computer downtime. Minimizing these failures is the responsibility of the modern-day facilities manager.

The surge in the number of digital devices, deregulation of wholesale power, and the increased demand for power combined to create this seemingly impossible challenge. Before deregulation and retail wheeling, utilities and government regulators shouldered the entire responsibility for maintaining electric generation and transmission systems. But now, electric service has become a competitive, erratic business, in which private utilities have little incentive to pay for the upgrades needed to provide the necessary level of reliability and support the increased demand for power across utility, state, and regional borders. Controlling maintenance costs has already become a bigger priority–especially in deregulated states–even as demands for increased uptime energy continued to grow. Despite the localization of deregulation today, this transformation is a global obstacle because isolated failures can domino into a nationwide crisis due to the complexity and interconnectedness of the nation's power grid networks.

Transformation into a Digital Society

There was a time when most corporations and institutions operated from 9 to 5 and data centers operated with batch punch cards. The mission critical facilities engineering field has evolved significantly from standard office build-outs that once included minimal electrical loads such as typewriters, calculators, and task lighting. Mainframe computers of twenty years ago are now powerful personal computers located on desktops in every office environment throughout the world. Devices such as cell phones, PDAs, and ATMs have become everyday items. The number of worldwide Internet users surpassed 530 million by the end of 2001 and is expected to reach over 1 billion by the end of 2005. Final 2002 e-commerce sales were nearly $80 billion and the market is predicted to grow into the trillions of dollars. Many companies and a colossal sum of money rest at the mercy of the mission critical facilities sustaining them.

Power protection equipment today must be able to handle a dangerously wide variety of power disturbances that can be generated anywhere along growing networks of servers, routers, gateways, bridges, and other sensitive electronic components. At the heart of almost all business lines today is extremely vulnerable computer hardware that absolutely cannot tolerate an interruption in power for more than 1/2 cycle or 8 milliseconds.

Risk Tolerance

Managers of all types and sizes of organizations and institutions need to be well-versed in power risk management and take an aggressive proactive approach to minimize safety hazards and financial damage during a power failure. It is not a question of preparing for if, but rather, for when, the next power outage will affect the continuous flow of business. In the past, downtime was usually a result of computer hardware or software failure. As technology improved, information services departments began to design hardware and software systems for increased reliability and redundancy. Today, scheduled hardware or software upgrades are the most likely causes for non-power-related computer downtime; however, the computer applications normally run on backup or mirror sites during upgrade periods. As a result, the computer systems have become more reliable than the electrical and mechanical infrastructure that supports them.

In order to design a building with the appropriate level of reliability, a company first needs to assess the cost of downtime and determine their associated risk tolerance. Downtime can no longer be equated to power availability, as recovery time is now a significant component of downtime. Today, recovery time is typically many times longer than utility outages as operations have become much more intricate and complex. Is a 32-second facilities outage really only 32 seconds? Is it perhaps 2 hours or 2 days? The real question is how long does it take for a facility to fully recover from the outage and return to normal operational status.

Facility engineers and senior management need to evaluate the cost of operating with obsolete electrical distribution systems and the associated risk of an outage. When the potential for such losses exists, serious capital expenditures to upgrade the electrical distribution system are monetarily justified by senior management. The cost of downtime in vast industries has expanded tremendously in recent years, as business has become completely computer dependent and systems have become increasingly complex.

Once management provides facilities engineers with the necessary backup systems, including uninterruptible power supplies and generators, power electronics, capital resources, training, and technology tools to capture the building's mission critical infrastructure, the facility will function at an increased level of reliability. Until then, the facilities manager cannot protect against a wide variety of hazards that may paralyze the business.

The electrical distribution systems in mission critical facilities today are so complex that it could take a minimum of one year to fully understand and integrate the systems from a technical, operational, and administrative standpoint. Most often, the facilities manager has only limited resources and support to maintain these intricate systems and achieve the appropriate reliability level. To change this situation, senior management must understand the direct correlation between relia-

bility and a positive bottom line.

Imagine the dilemma of a manager responsible for a major data center that provides approval of checks and other online electronic transactions for American Express, MasterCard, and Visa. On the biggest shopping day of the year, the day after Thanksgiving, the data center loses utility service. An uninterruptible power supply (UPS) and onsite standby generator provide some assurance; however, the standby generator has not started due to a fuel problem and the data center will shutdown in 15 minutes, which is the capacity of the UPS battery at full load.

The problem could have been identified and prevented if the standby generator was exercised every week for 30 minutes. Precautionary protection is often worth the extra expense.

Many companies do not consider installing back-up equipment until after an incident has already occurred. During the months following the 2003 blackout, the industry will see an increased number of requests for the installation of UPS systems and standby generators. Some businesses that are not typically considered mission critical learned that they cannot afford to be unprotected during a power outage. The blackout destroyed $250 million of food in New York City alone. In addition, small and large businesses alike continually learn how susceptible they are to power disturbances and the associated costs of not being prepared. In fact, there are about three times more UPS systems in use today than there were 10 years ago.

Electric Utility Deregulation

Within the past few years, some states have seen the deregulation, or restructuring, of many electric utilities and increased transmission of electricity from buyer to seller over a transmission lines owned and controlled by another party (see figure 2). Senior management needs to better understand that deregulation of wholesale markets has changed the local utilities' responsibility for providing service. While deregulation and retail wheeling were supposed to provide more choice to the consumer, there are signs that these changes will reduce power quality and reliability. Changes brought about by this type of restructuring only increase the importance of the facility manager.

The last few years have brought several power reliability events in California, New York, Chicago, Nevada, New England, the Mid-Atlantic States, and the Northwest. These areas experienced severe voltage fluctuations and power outages during peak usage, as utilities and regional transmission operators were not prepared to meet high demand or react to emergency conditions.

A January 2000 Department of Energy (DOE) study of the events during the summer of 1999 stated that electric utility deregulation has caused significant degradation in the North American power grid reliability during peak usage periods.

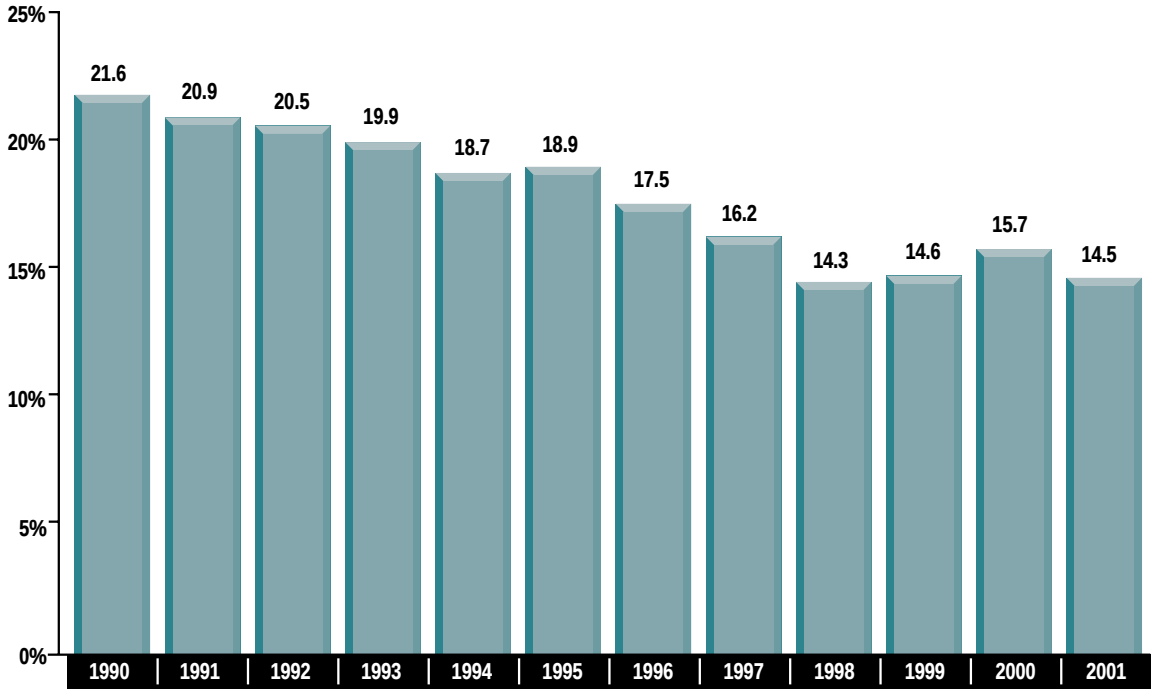

Figure 3. Average summer spinning reserves 1990-2001 (Continental US) Source: Electric Power Annual 2001, U.S. Department of Energy

The DOE cited aging infrastructure and increased demand for power as the primary causes of stress on the transmission and distribution system that led to the interruption of service. The study concluded, "State and federal regulatory policies are not providing adequate incentives for utilities to maintain and upgrade facilities to provide an acceptable level of reliability."

Without oversight from regulatory agencies, electric utilities are encountering difficulty in balancing reliability and price to compete in a deregulated market. Most competitive utilities are attempting to run operations as close to maximum capacity as possible with minimal or no spinning reserves and standby generation capacity. Twenty years ago, however, it was common to see utilities with spinning reserves in the range of 25% of maximum capacity (see figure 3). Today, utilities are streamlining costs and operating with considerably less spinning reserves than in the past, thus increasing the probability of outages and brownouts, as well as the need for standby power systems.

California can blame its severe energy crisis, at least in part, on its transition to a competitive electricity marketplace. In the past, state regulators and local utilities were responsible for ensuring an adequate and reliable energy supply; however, in a deregulated market, no organization holds such responsibility. The availability of energy is solely based on market pressures, and with a rate freeze on utility service, there is little incentive for customers to limit energy consumption, even during a time of crisis. California utilities were left without resources to meet booming demand.

The DOE predicts more power reliability events unless significant measures are taken to improve the reliability of competitive retail utilities. Some have suggested that a federal agency be established to act as a supervisory organization to ensure that all competing utilities are supplying a suitable level of reliability. Others believe that states need to rescind their deregulation rulings and legislation to reinstitute the old regulated utility scheme.

The emergence of the electric grid as a political issue in the wake of the Blackout of 2003 makes it likely that a larger percentage of the local, state, federal, and private sector budgets will be allocated to the reconstruction of the current electric distribution system. Over the next 20-30 years, the government and privately owned utilities will have the opportunity to rectify many of the drawbacks of the current electrical distribution system. In addition, utilities may have the opportunity to expand capacity with new electric generation systems to meet the growing demands of years to come. In the interim, end users will have to cope with increased disruptions of utility service.

During the development of increased generating capacity, national reconsideration of the generation sector could encourage further use of environmentally friendly or green power. Photovoltaics, fuel cells, wind power, and geothermal energy are common examples of green power technologies. Increased use of these technologies could lead to increased reliability and limit the emission of greenhouse gases from fossil technologies. Further, the increase of these sources will add diversity to the electrical system, reducing U.S. reliance on fuel from foreign markets and diminishing U.S. vulnerability to oil price spikes.

As apparent from the blackout of 2003, a massive overhaul of the current electrical infrastructure is necessary to improve reliability to meet modern digital demands. However, no matter the type of power generation or the amount of money dedicated to renovating the electrical infrastructure, no electric service provider could ever guarantee 100% availability. As a result, the job of the mission critical facilities engineer will persist indefinitely as the sustaining force for 7x24 mission critical operations. ***eun***

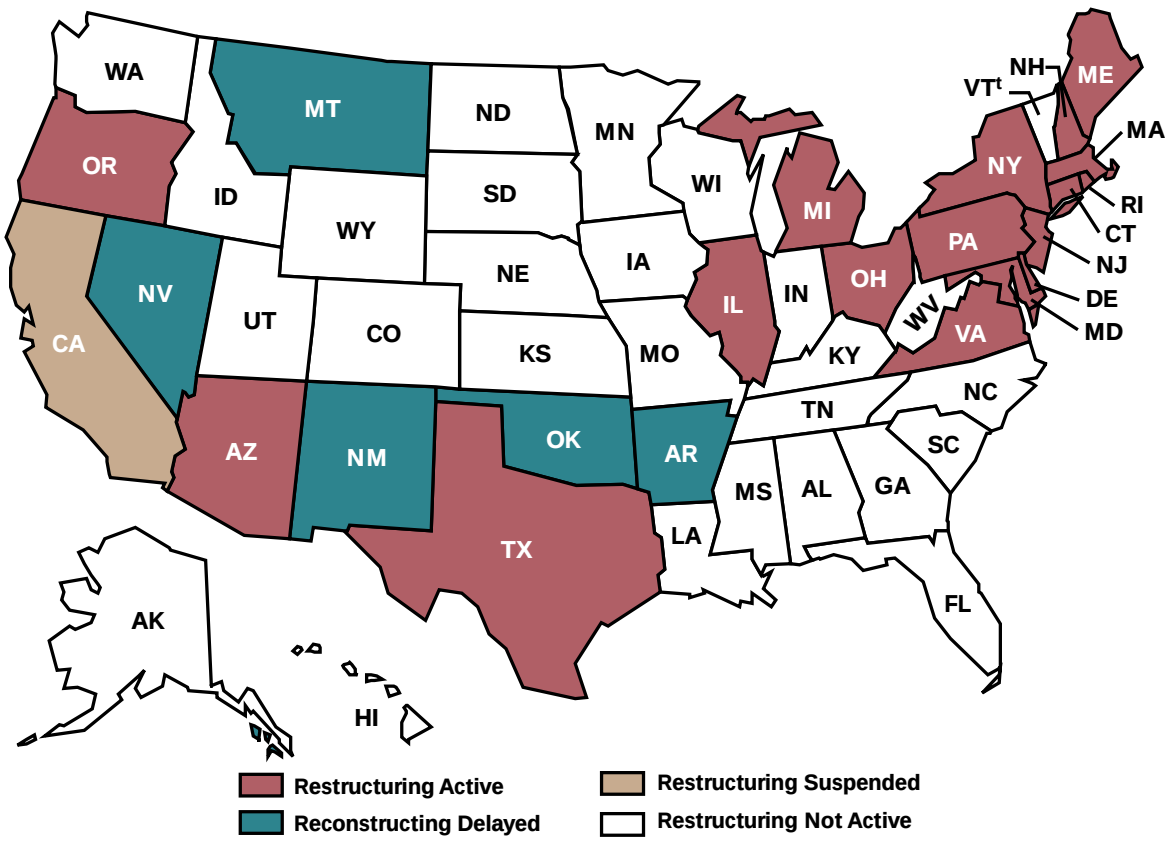

Figure 2. Electric industry restructuring activity (as of February 2003) Source: Status of State Electric Industry Restructuring Activity, U.S. Department of Energy

About the Author: Peter M. Curtis is the president and founder of Power Management Concepts, LLC in Woodbury, NY. He is also associate professor at the New York Institute of Technology and New York University where he provides online education courses in facilities operations and maintenance. He is a published author, with recent publications including the IEEE e-book, An Introduction to Mission Critical Facilities Operations. Additional information can be found at www.powermanage.com