Willis Technical Advisory Bulletin

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March 2004 – Protection Strategies for Electrical Power Outages

This Willis Technical Advisory Bulletin offers an overview of business exposure to electric utility service outages. It surveys a range of approaches to reduce those exposures or ease their impact. These include contractual answers, such as service interruption insurance, and physical answers, such as installed backup power supply equipment.

Background

How Electrical Distribution Works

Most electrical power used in North America is generated at large, investor-owned power plants. These are generally coal fired, oil fired, natural gas fired, nuclear or hydroelectric, but there are some alternative energy utility plants as well.

The voltage of electrical power is stepped up or down using transformers. Typically, power is stepped up to high voltage near the generating plant for long distance transmission. At substations, power is stepped down to medium voltage for shorter distance distribution. For most consumers of electricity, whether industrial, commercial or residential, the power is converted to its final, usable voltage by a transformer at or very near to the consumer's location.

Taken together, the entire system of generating plants and distribution network is known as the Grid. The Grid interconnects the electrical supplies for most of the country, although it is split into an Eastern Grid, a Western Grid and the Texas Grid.

The Closer the Line, the Greater the Risk

As a whole, the Grid is very reliable and resilient. The Grid can continue to operate despite the failure of specific individual components, even very large generating plants or substations. The most significant disturbances to the Grid in living memory both hit the East Coast. In 1965, 30 million people lost power for as long as 13 hours; in 2003, 50 million people in eight states lost power for as long as 24 hours.

Wide area power failures like those blackouts are low probability events. More common are local problems such as substation transformer fires or explosions. Wind or ice can force tree limbs onto power lines and occasionally blow down power lines. Another source of outages is damage to underground power and water transmission lines by contractors.

The reliability of the electrical system declines the closer the power gets to the customer, with the greatest vulnerability appearing in the so-called "last mile" up to the actual fixtures and machines you use. Usually there is little or no redundancy in the connection between the point of use and the nearest substation, so the failure of a single transformer or power line can cause an outage in your service area. Storms can exaggerate these local vulnerabilities by disabling numerous power lines at the same time and taxing repair capacity.

Financing the Risk

The risk is clear. What about solutions?

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Service Interruption Insurance

First-party loss arising from electrical power outage is addressed under an insurance coverage known variously as Utility Services, Service Interruption or Utility Interruption coverage. This coverage is generally only available for losses that result from sudden physical damage to utility equipment such as power generating stations, transformers or transmission or distribution lines. Losses that result from other causes, such as operator error or system under-capacity, are usually not covered by most insurance. Sometimes operator error can qualify as a form of damage. A deliberate reduction by a utility, public authority or the insurance buyer does not normally trigger coverage.

Coverage is usually found in both Commercial Property and Equipment Breakdown policies. In each, look for coverage of three types of loss: Direct Damage, Spoilage and Business Income/Extra Expense. A power outage can cause each of these.

Electrical Purchase Contracts

Insurance is not the only contractual answer to electrical outage exposure. Two other options to consider are electrical purchase contracts and energy asset outsourcing contracts.

These alternatives exist because in today's world there are many ways to purchase electricity. Power can be purchased from a local utility, from other utilities and from electrical brokers or wholesalers. Rate plans are as varied as wireless telephone plans and include many of the same factors, such as peak versus off-peak usage, guaranteed usage levels versus variable usage, and length of contract commitment. Many utilities provide a rate reduction for customers willing to be identified as interruptible, meaning that power can be shut off with little or no notice if needed in order to supply other customers. Some contracts include penalties if peak demand thresholds are exceeded.

To supplement the protection of an electrical purchase contract you might consider installing equipment to minimize your outage exposure (see below). Either way, any change in your physical plant relative to your electrical demand or supply should include a review of your electrical purchase terms.

Energy Asset Outsourcing

Another way to address electrical exposures is an energy asset outsourcing contract. In this arrangement, a company sells off various energy assets (such as heating and cooling equipment and backup electrical generators) to a third party that specializes in managing such equipment. As part of the arrangement, the company agrees to buy heating, cooling and electricity from the third-party company over a long term at specified rates. The third party is responsible for system reliability and outages can trigger penalties under the contract.

These types of contracts are best suited to organizations that do not have the internal resources to manage energy assets effectively. However, they should be viewed with a careful risk management eye. Some companies have found that they have simply traded one kind of risk for another. The third-party company must of course have a solid balance sheet with proven ability to pay any penalties it may incur. Until recently, one of the largest companies offering these contracts was Enron Energy Services.

Minimizing the Risk at the Local Level

Some prefer to take matters into their own hands. Here are five physical ways to address the problem of electrical outage exposure:

- Additional utility line
- Uninterruptible power supply (UPS)
- Emergency generator
- Distributed power equipment/cogeneration
- Electrical equipment maintenance

Additional Utility Line

For a large plant or facility, a second incoming power line can provide a dramatic increase in reliability. The second power line should be as far from the first line as possible to minimize the chance of both lines being affected by a single event. Additional power lines need to be negotiated with the supplying utility and require additional distribution equipment within the plant or facility. The cost of a second power line can be substantial and depends on the amount of equipment the utility and the user need to install. A second power line will not provide protection against a wide area utility outage.

Uninterruptible Power Supply (UPS)

An Uninterruptible Power Supply (UPS) is becoming a standard part of computer system infrastructure requirements. If data centers lose power unexpectedly, the resultant crash can cause expensive losses of data and functionality. UPS systems are generally designed to shield computer installations from short-term dips and spikes in the

power supply. In the event of an extended outage, a UPS system is intended to provide for an orderly shutting down of the computer center, including saving data.

UPS systems are not generally designed to maintain power during extended power outages. UPS systems, however, serve several important functions, and should continue to be used even if other physical solutions to outage exposures are implemented. UPS systems should be considered for all mission-critical equipment and not just major data centers.

Emergency Generators

Emergency electric generators provide a means of maintaining some portion of the electric power load for an indefinite time during a utility outage. On-site generators are required at certain facilities such as hospitals where lives depend on electrical power. Many other facilities and an increasing number of homeowners are investing in backup generators as a physical form of protection against power outages.

Most backup generators are powered by internal combustion engines and fueled by gasoline, diesel fuel or natural gas. Units can be set to power up automatically in the event of an outage or may require manual starting. Units are typically sized to support a scaled-down electrical load that is well below normal demand. Backup generator units should be started up and maintained on a regularly scheduled basis to minimize the chance of failure.

Distributed Power Equipment/Cogeneration

Distributed power and cogeneration units are also on-site generating systems. The difference between these units and an emergency or backup power generator is that they are intended to be run regularly, not just during utility outages. They may be operated continuously or they may be operated during hours of peak demand or peak electrical cost, to minimize expenses.

Gasoline and diesel engines are not typically used for these purposes because of fuel storage limitations, but natural gas-fueled engines, especially turbines, are widely used. Gas turbines come in an increasingly wide range of sizes, from utility grade power producers to remarkably compact "micro-turbines." An emerging technology in this area is fuel cells, which are just beginning to be commercialized for distributed power applications.

The term cogeneration generally refers to cases where the heat from any of these units is used to provide heating or hot water to the facility. Where feasible, this approach improves the economics of installing power generating equipment.

Electrical Equipment Maintenance

All of the physical answers noted above involve adding new equipment and changing the electrical configuration at a location to provide backup capacity of one kind or another. An equally important, and much less expensive, approach is to make sure the existing electrical distribution equipment is properly maintained. Preventable failure of on-site electrical distribution equipment causes many power outages. Oil testing of electrical transformers and infrared scanning of electrical panels and wiring are proven techniques for avoiding electrical outages by finding problems before the equipment actually fails.

Business Continuity Planning

Even the most thorough preparation cannot entirely eliminate the risk. The threat of loss of profits, jeopardized market share, and decreased shareholder value should inspire every organization to invest in business continuity planning. Willis Property Risk Control consultants can assist you in such planning – as well as offer advice about all of the options surveyed above.

If you would like to discuss your exposures to electrical outages, contact your local Willis representative, or Joe Stavish, PE, North America Property Risk Control Practice Leader, at 800 862 1441, stavish_jc@willis.com.

References: NFPA 70E, *Standard for Electrical Safety Requirements for Employee Workplaces* and NFPA 70, *National Electric Code*, offer additional guidelines related to electrical safety.

Sources:

Mark MacGougan, "Down, But Not Out — How to Protect Your Organization from Electrical Power Outages," *The Locomotive* (The Hartford Steam Boiler Inspection and Insurance Co., 1997).