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The Locomotive

How to Protect Your Organization from Electrical Power Outages

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Introduction

This article is a basic discussion of the issue 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 back-up power supply equipment. The following information serves as an introduction; more in-depth information can be found in previous Locomotive articles which are listed at the end of this discussion.

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 alternate energy utility plants as well.

The voltage of electrical power is stepped up or down using transformers. Typically, power is stepped up near the generating plant to high voltage for long distance transmission. At substations, power is stepped down to a 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 on 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 disturbance to the Grid in living memory was the East Coast blackout of 1965, when 30 million people lost power for as long as 13 hours.

The reliability of the electrical system becomes lower as you get closer to the individual office or plant, with the greatest vulnerability appearing in the so called "last mile" up to the actual physical connection to the user. There is little or no redundancy in the connection between a utility customer and the nearest substation, so the failure of a transformer or power line will cause an outage in that service area. Storms can sometimes disable numerous power lines at the same time, taxing repair capacity and extending the outage time in affected areas.

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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. Losses that result from other causes, such as operator error or system under-capacity, are not covered by most insurance.

You should look for this coverage under both your Commercial Property coverage and under your Equipment Breakdown coverage. In each of these categories, you should look for coverage for three different types of loss scenarios: Direct Damage, Spoilage and Business Income/Extra Expense. A power outage can cause each of these types of loss. Contact your company's risk manager or an insurance professional for more information.

Electrical Purchase Contracts

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

In today's world, there are many ways to purchase electricity. You can purchase power from your local utility, or from other utilities, or from electrical brokers or wholesalers. Rate plans are as varied as the 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.

You need to understand your electrical purchase contract in order to analyze the potential benefits of installing equipment to minimize your outage exposure. 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 kind of contract that has been used 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 back-up 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 worth considering by any organization that does 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. Up until recently, one of the largest companies offering these contracts was Enron Energy Services.

Maintaining Reliability

Here are five types of physical answers to the problem of electrical outage exposure:

1. Additional utility line
2. Uninterruptible power supply (UPS)
3. Emergency generator
4. Distributed power equipment/cogeneration
5. 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 the same physical loss. Additional power lines need to be negotiated with the supplying utility and will require additional distribution equipment within the plant or facility. The cost of a second power line can be substantial and will depend 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 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 Generator

Emergency electric generators provide a means to maintain 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 back-up generators as a physical form of protection against power outages.

Most back-up 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 the normal 100 percent electrical demand. Back-up generator units should be started up and maintained on a regular schedule to minimize the chance of failure when needed.

Distributed Power Equipment/Cogeneration

Distributed power and cogeneration units are also on-site generating systems. The difference between these units and an emergency or back-up 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 electrical cost.

Gasoline and diesel engines are unlikely to be used for this service because of fuel storage limitations, but natural gas fueled engines may be used. Also, natural gas fueled turbines are widely used for these applications. 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 the power generating equipment.

Electrical Equipment Maintenance

All of the physical answers noted above involve adding new equipment and changing the electrical configuration of a location to provide back-up capacity of one kind or another. An equally important, and much less expensive, physical answer is to make sure the existing electrical distribution equipment is properly maintained. Preventable failure of on-site electrical distribution equipment can and does cause 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.

For Further Information: These related articles can be viewed in *The Locomotive* library.

"Preparing for an Electrical Power Outage"

"Loss Mitigation Action Plans"

"Guidelines For Providing Surge Protection"

"Keeping the Lights On: An Action Plan for America's Aging Utility Transformers"

"An Analysis of Transformer Failures," Part 1 and Part 2

"Electrical Preventive Maintenance"

"Protecting Electronic Equipment from Lightning and Voltage Surges"

"Transformer Oil Testing"

"Increasing Transformer Reliability Using Insulating Oil Analysis"

"Short-Circuit and Protection Coordination Studies"

"Infrared Thermography: Taking the Heat off Faulty Connections"

[In a future issue: Cost Benefit Analysis. It is difficult for many organizations to analyze the costs and benefits of back-up electrical supply equipment. If you can quantify your financial exposure to outages, you can compare those numbers to the annualized costs. We will provide a sample calculation.]

About the Author

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