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ELECTRICAL SERVICE

Keeping the Juice Flowing

Nothing shocks me. I'm a scientist.

INTRODUCTION —HARRISON FORD, AS INDIANA JONES

This chapter is provided so you will have a basic understanding of electrical power support for your critical equipment. Use the information as a background when talking to your facility electrical engineer and your UPS supplier. While you'll not want to work on high-voltage circuits or equipment yourself (leave that to trained professionals), an overall knowledge of how your electrical systems work will help you to write a better plan.

ELECTRICAL SERVICE

Imagine a business in which if you create too much product it is immediately lost forever. A business where people only pay for what they use, but demand that all they want be instantly available at any time. A product they use in varying amounts throughout the day. A product that requires an immense capital investment but is sold in pennies per unit. Welcome to the world of electricity. Electrical service is so reliable, so common, that people take it for granted that it will always be there whenever they want it. Electricity is an essential part of our everyday existence. Few businesses could run for a single minute without it.

Side-stepping the issue of the huge effort of the electric company to ensure uninterrupted service, let's consider the impact of electricity on our business. Without a reliable, clean source of electric power, all business stops. We have all experienced an electrical blackout at some point. When we add together how important electricity is and that we believe a blackout is likely to occur again, we meet all the criteria for requiring a disaster recovery plan. Because we cannot do without it and there are economically feasible disaster containment steps we can take, a mitigation plan must also be drafted.

In addition to recovering from an outage, our mitigation plan will reduce the likelihood of losing power to critical machinery. There are many other problems with electrical power beyond whether we have it or not. Therefore our mitigation plan must address ensuring a clean as well as a reliable electrical supply.

In the case of electricity, we need a process that:

- Monitors the line and filters out spikes.
- Provides additional power in case of a brownout or partial outage.
- Provides sufficient temporary power in case of a total outage.
- Makes the transition from normal power supply to emergency power supply without loss of service to critical devices.

Whatever power support plan you select, keep in mind that it must be tested periodically. With luck, you will be able to schedule the tests so that a power failure will have minimal impact. With a touch of bad luck, nature will schedule the power outages for you and, again, at that time you will know how well your power support plan works.

RISK ASSESSMENT

What sorts of problems are we protecting against? In an ideal situation, North American electricity is provided at 120 volts, 60 cycles per second, alternating current. If we viewed this on an oscilloscope, the 60 cycles would display a sine wave. There are many variations from "normal" that will play havoc with your reliable power connection.

The most common electrical power problem is *voltage sag*, or what is more commonly known as a "brownout." Generally speaking, this is a reduced voltage on the power line; you can see a brownout when the room lights dim. Sags can cause some computer systems to fail and occasional hardware damage by forcing equipment power supplies to work harder just to function.

Sags can be caused by turning on power-hungry equipment. As they begin operation, these power hogs draw the amount of electricity they need to run from

be anything from heavy machinery to the heater under the desk next door. Most sags are of short duration.

Brownouts can also be caused by utility companies switching between power sources and, in some situations, there may be an intentional voltage drop by the electrical company to cope with peak load conditions. An example is the summer of 2001 power crisis in California; the state endured rolling brownouts when the electric utility company could not meet peak demand. The demand for electrical power is growing, but the supply of electricity is not.

Once a voltage sag ends, there is typically a corresponding “spike” of “overvoltage” that can further damage equipment. Sharp or extended overvoltages can severely damage your electronic systems, which are not designed to receive and handle large voltage variations.

Another common electrical power problem is a *voltage surge*, which is a short-term substantial increase in voltage caused by a rapid drop in power requirements. A typical surge lasts for three nanoseconds or more (anything less is known as a spike). Surges are caused by major power users being switched off. For that brief moment, the power available for that item is still being supplied but is no longer needed and must be absorbed by other devices on that line. Examples of large users that may be switched off are factory equipment, air-conditioners, and laser printers.

Surges frequently occur and usually go unnoticed. Some can be handled by the equipment’s power supply; some must be absorbed by a surge protector, and the rare major surge will wipe out anything in its path. A common example of a major power surge is a lightning strike that surges down power and telephone lines into nearby equipment.

Noise is seen as jitters riding along on the 60-cycle sine wave. It is electrical impulses carried along with the standard current. Noise is created by turning on electrical devices, such as a laser printer, an electrical appliance in your home, or even fluorescent lights. Did you ever see “snow” on your television screen when using an electrical appliance? That is an example of line noise sent back into your electrical system. What you see on the screen is electrical noise riding on your local wiring that is too powerful for your television to filter out.

Noise is one source of irritating PC problems, such as keyboard lockups, program freezes, data corruption, and data transfer errors. It can damage your hard drives and increase audio distortion levels. The worst part of the problem is that in many cases you aren’t even aware of what is happening when it occurs.

Voltage spikes are an instantaneous increase in line voltage that is also known as a “transient.” A spike may be caused by a direct lightning strike or from the return of power after a blackout. Think of a spike as a short-duration surge that lasts for two nanoseconds or less. Spikes can be very destructive by corrupting data and locking up computer systems. If the spike hitting the device is intense, there can be significant hardware damage.

An *electrical blackout* is a total failure of electrical power. It is any voltage drop to below 80 volts since, at that point, most electrical devices cease to function. Blackouts have a wide range of causes from severe weather to auto accidents to electrical service equipment failures.

A blackout immediately shuts down your equipment, and it is time-consuming to restart most machinery from a “hard stop.” Even though most blackouts are of a very short duration, from a business perspective a momentary blackout can be just as serious as a two-hour outage. In addition, some equipment may not have been turned off for years—and for good reason. There may be some doubt as to whether it will even start again!

Blackouts are very damaging to computer systems. Anything residing in memory, whether it is a spreadsheet or a server’s cache, is immediately lost. Multiply this across the number of people working in a single building, and you can see the lost time just for one occurrence. Compounding the data loss is the damage and weakening of your equipment. A further issue is that, from a recovery perspective, there may be network devices working out of sight in a closet deep within the building. If you don’t know these exist or where to find them, just the process of restarting equipment can be very troublesome.

When recovering from blackouts, beware of the corresponding power surge that accompanies the restoration of system power. So, when a blackout strikes, turn off your equipment and do not restart it until a few minutes after power is stabilized.

YOUR BUILDING’S POWER SYSTEM

Many years ago, your company’s delicate data processing equipment was concentrated in the facility’s data processing center. Often one whole wall was made of glass so everyone could see this technical marvel in action (hence the term “glass house” for computer rooms). This concentration allowed the equipment to be supported by a few Uninterruptible Power Supply (UPS) units and power line conditioning devices.

Now, the primary computing muscle for most companies is spread all over the facility in the form of PCs and departmental servers. Instead of a carefully conditioned and electrically isolated power feed, your equipment shares the same power circuits as soda pop machines, copiers, and factory machinery—all of which add noise and surges to the power line. None of this is good for your computer systems and network devices.

This variety of computing power creates a need to monitor electrical service to ensure maximum network and computer capabilities. The emphasis is on the network because while personal computers are located comfortably on office desktops, network hubs, routers, and bridges can be found stuffed in any closet, rafter, or crawl space, or under a raised floor. This makes the automatic monitoring of electrical service across your facility an important network management function.

Filtering the electricity as it enters your building is a good practice to minimize external influences. Sometimes, however, the problems are caused by equipment inside your building; this might be welders or heavy machinery.

Power protection for business continuity is a five-step process:

1. Isolate all your electronic equipment from power surges by use of small surge protectors. Power surges sometimes occur internal to your building. Surge strips are inexpensive and simple to install.
2. Use line conditioning units. A line conditioner smoothes out voltage variation by blocking high voltages and boosting the line voltage during brownouts. This filtering should always be applied to the power line before electricity is passed to your UPS.
3. An Uninterruptible Power Supply provides electrical power for a limited time during the event of a power outage. The UPS battery system can also help to protect against brownouts by boosting low voltages. A UPS is a critical device for ensuring that key components do not suddenly lose electrical power.
4. One of the best solutions for companies that cannot tolerate even small power outages is an onsite electric generator. These backup units instantly start and begin generating electricity to support your facility. Imagine a hospital's liability if all their life support equipment suddenly stopped from a lack of power. This added security is not cheap to install or maintain. Keep in mind that electrical generators of this sort are internal combustion engines and must conform to local air pollution and building regulations.
5. Physically secure the electrical support equipment. Few people require access to this equipment, and it must be safeguarded against sabotage. This equipment is unique in that if someone disabled it, the entire facility could stop with lost production quickly running into the thousands of dollars per minute. Additionally, the "hard stop" on machinery and computer servers will result in lost or corrupt data files.

However you secure this equipment, keep in mind the cooling and service clearance requirements for the UPS system. The UPS control panel must also be available to the disaster containment team in a crisis.

SURGE PROTECTION

One of the most common electrical protection devices is a surge protector power strip. Computer stores sell these by the bushel. For your dispersed equipment, a surge protector can provide some measure of inexpensive protection. A typical surge protector contains circuitry that suppresses electrical surges and spikes. All electronic devices should be attached to electrical power through a surge strip, including all your PCs, network equipment, printers, and even the television used for demonstrations in the conference room. Even if your facility's power is filtered as it enters the building, a direct lightning strike can ride the wires inside the building and still fry your equipment.

There are many brands of surge suppressors on the market. There are places to save money and places to lose money. The old saying goes "for want of a nail, the battle was lost." When protecting your equipment from power problems, you may not want to skimp too much. Here are some things to look for when buying a surge strip:

■ **Joule Ratings.** A joule rating is a measure of a surge protector's ability to absorb power surges. A joule is a unit of energy equal to the work done by a force of one Newton through a distance of one meter. Generally, the higher the rating the better. A good surge suppressor will absorb between 200 and 400 joules. If greater protection is needed, look for a surge suppressor rated at least 600 joules.

■ **Surge Amp Ratings.** This rating is the amount of above-normal amps the surge protector can absorb. As with joules, the higher the better.

■ **UL 1449 Voltage Let-Through Ratings.** Underwriters Laboratories tests to determine how much of a surge is passed by the surge protector on to the equipment it is protecting. The best rating is 330 volts. Any voltage rating less than 330 adds no real benefit. Other ratings of lesser protection are 400 and 500. Be aware that UL 1449 safety testing does not test for endurance.

■ **Response Time.** The response time of the surge protector is important. If it blocks high voltages but is slow to react, then it is of marginal usefulness. Adequate response time is 10 nanoseconds or less. The lower the number, the better.

■ **All-Wire Protection.** A high-quality surge protector guards against surges on the ground wire, as well as the current-carrying wires.

■ **Telephone Line Support.** A quality surge protector includes protection for your modem from power surges riding on the telephone wire.

■ **Clamping Voltage.** The voltage at which the surge suppressor begins to work. The lower the rating, the better. Look for a rating of 400 volts or less.

Some surge protectors provide basic line conditioning against noise on the line. This circuitry can smooth out minor noise on the lines.

An interesting thing about the ubiquitous surge protector strips is that in addition to protecting equipment, they make handy extension cords. Over time, these surge strips may silently have absorbed any number of electrical "attacks" that have eroded or destroyed their ability to protect your equipment. Most people aren't aware of this because their surge strips still function quite nicely as extension cords.

Surge protectors often have lights to tell you when they are energized or not. High-quality surge protectors will have an additional light to let you know if their surge-fighting days are over. This light may say something like "protected" or "surge protection present." If your surge protector has such a light and it is no longer lit when running, then you may have a false sense of security that it is functioning as something other than an extension cord, yet that is all it now is.

People traveling around the country using a notebook computer would be well advised to carry and use high-quality surge protectors when plugging their equipment into the local power grid. When you consider how big a typical surge suppressor is and how tiny notebook PCs have become, you can guess at how

A few more things to consider when using surge protectors. As great a tool as they are, they cannot stop a nearby lightning strike from damaging your equipment. When a lightning storm approaches, unplug both the power strip and your network cable from the wall. (This is good advice for any sensitive electronic equipment that depends solely on a surge protector to defend against lightning.)

Also, never use a ground eliminator with a surge strip (a ground eliminator converts a three-prong plug into a two-prong plug for use in an older building). Doing so will make it difficult if not impossible for your surge protector to resist a major line surge.

LINE CONDITIONING

Line conditioning ensures that your equipment always receives the same steady voltage. It also screens out noise on the power waveform. Line conditioning involves passing your normal electrical service through filtering circuitry before it is used. Many people don't realize that the "old reliable" electricity that magically comes out of the walls is susceptible to a wide range of influences. These influences take the "pure" 60-cycle alternating current and introduce fluctuations in the voltage or current as it passes down the line.

These fluctuations can have many sources but one that we especially want to avoid is lightning. Lightning can cause a localized one-shot power surge to roar down the electrical line into your equipment. When this happens, equipment power supplies and integrated circuits can quickly melt.

Line conditioning is also advised for analog telephone lines connected to PC modems. The same lightning strike that induces an electrical charge in your electrical power lines can throw a jolt down your telephone line. Unfortunately, PC modems have little protection against a power surge, and they are very easily destroyed. Many surge suppressors now include a telephone line surge suppression jack to filter these problems out.

A line conditioner should always be installed between a UPS and the electrical power source to reduce the load on the UPS batteries. Some UPS units include a line filtering capability. Check your model to see what it is capable of doing. A line conditioner reduces the number of times that the UPS jumps on and off battery power (which shortens the life of your batteries).

A line conditioner is an essential component when generating your own emergency power. Use it to filter the electricity provided by the generator before it is passed on to delicate computer hardware. The power delivered by a generator is not as clean as that normally delivered by the power company.

UNINTERRUPTIBLE POWER SUPPLIES

An Uninterruptible Power Supply provides several essential services and is best used in conjunction with surge protection and line conditioning equipment. A UPS can help to smooth out noisy power sources and provide continuous power during electrical sags. Its primary benefit is to provide temporary electrical power during a blackout. Depending on the model, it may also provide some measure of line conditioning protection.

Uninterruptible Power Supplies come in three basic types, based on their features.

1. The basic UPS is a "standby" UPS. A standby UPS provides battery backup against power outages (blackouts and brownouts) and a modest amount of battery-powered voltage correction.
2. The "line interactive" UPS is a step above the basic unit. It provides voltage regulation as well as battery backup by switching to battery power when line voltages move beyond preset limits. This type of UPS converts a small trickle of electricity to charge its batteries at all times. When power fails, the line interactive UPS detects the power loss and switches itself on. A line interactive UPS has a subsecond switching time from line power to battery power.
3. An "online" UPS sits directly between the line power and your equipment. The online UPS is always providing power to your electric circuits and has a zero transfer time between the loss of line power and the start of battery power.

UPS BATTERIES

UPS systems provide power during a blackout by drawing on their battery electrical supply system. Most of these batteries are sealed lead acid batteries. Unlike the batteries found in many notebook PCs, these batteries do not have a "memory" and should be completely drained as few times as possible. Depending on how often your UPS draws on its batteries, they should last up to five years. Remember that brownouts and short-duration blackouts all wear on the batteries, so if your local power fluctuates very much, the life of your batteries will be reduced. The speed at which your UPS batteries age is also determined by their environment. Extreme heat or cold are not good for your batteries. Refer to your manufacturer's guide for the recommended operating temperature range.

As batteries age, their power-generating capability will decrease. Therefore, regular preventive maintenance is important. Preventive maintenance should include changing the air filters to help keep the UPS unit cool. At that time, all the batteries should be checked for damage, leaks, or weak cells. You should also consider a service agreement that includes the replacement of damaged batteries.

UPS systems use "inverters" to convert the DC battery power to AC power. An inverter is electrical circuitry to change the direct current to alternating current. High-quality UPS systems use a dual inverter system for smoother power conversion.

UPS "SIZE"

The first question people ask about UPS units is, "How big does it need to be?" This all depends on several factors:

- What must be supported? This translates directly into how much electricity must be supplied at a given point in time.
- How many minutes must the battery pack provide this level of support?

UPS units are rated according to the number of volt-amps they can deliver. Volt-amps are different from watts and you cannot equate the volt-amps provided by a UPS with the watts used by an electronic device. The typical power factor (watts per volt-amp) for a workstation is 0.6 or 0.7. So, if your PC records a drain of 250 watts, you need a UPS with a 417 volt-amp rating (for a 0.6 power factor). Always be careful to never overload a UPS beyond its rated capacity. Doing so will severely damage it.

Most UPS manufacturers have a software tool for estimating UPS sizes. Where possible, use their programs to size your UPS. In the absence of that tool, you can make an estimate following these steps:

1. Begin with a list of all equipment for which you will need to provide electricity. This may include personal computers, monitors, servers, critical printers, network hubs, and telecommunications equipment—whatever will be supported by the UPS.
2. Determine the wattage ratings on all these devices by checking their nameplates. The numbers may be expressed as watts. We need the numbers in volt-amps (VA) since that is a more accurate number for UPS sizing. Multiply the watts by 1.4 to get the volt-amps load.
3. If the power usage is provided in amps, then multiply that number by the line voltage (120 volts in North America and 230 volts for Europe) to get a volt-amp rating.
4. Total the volt-amp requirements for all the supported equipment. This is the amount of load you need to support. From here you check with the manufacturer for the size of unit to support this load for the amount of time you select.

SWITCHING TO BATTERIES

A UPS uses power line filters to address minor power disturbances, but its main weapon against a power loss or severe brownout is a near-instantaneous switch to battery power. This is good for keeping your systems alive but hard on the batteries. If your UPS must often switch to batteries because of poor power regulation in your area, then your battery life will suffer significantly. As the batteries rapidly age in this environment, they would not provide protection for the length of time you may be counting on from your UPS.

Recharging the batteries is another issue. Some UPS systems allow you to choose between a fast recharge or a slow recharge. The frequency and duration of outages in your area should determine if you must recharge your batteries as fast as possible or use a gentler, slow recharge process. Fast recharging puts a large drain on your restored power supply.

If you switch to generator power, you do not want the batteries to recharge from the generator as it might take away too much of the power needed elsewhere. If you plan to recharge the batteries from the generator, be sure that is included in the power load plan when sizing the generator and that the batteries are on a slow recharge cycle.

UPS LOCATIONS

If you have concentrated your data processing main computers and servers into one room, then selecting a location for your UPS will be easy. Electricians will run a separate electrical circuit from the UPS to the equipment to be protected. Electrical codes require these outlets to be a different color so you will know which circuit you are plugging into.

Some critical machinery and computers will be located away from the central computer room. For these devices, consider smaller UPS units located adjacent to the equipment. These units will not have a long battery life and will be used to keep the machine operational long enough to shut it down gracefully. Be sure not to lose sight of these satellite units as they will need to be tested and their batteries maintained over time. Remote monitoring software is ideal for this situation.

ADVANCED UPS FEATURES

Modern UPS units offer much more than battery backup. They possess microprocessor logic to support a wide range of services. They can provide alarms of error conditions both on the unit and through your data network. This is a very useful feature since they are often stuck in some dark back room where an audible alarm only serves to annoy the mice.

The network signaling of power conditions is a very useful feature. Depending on the capabilities of your UPS and data systems, a UPS can start the orderly shutdown of equipment to protect it before the UPS batteries are exhausted. This feature is very useful over weekends and holidays when no one is around. In some cases, it can order a restart when power is restored. A more sophisticated UPS system stores a log of the power supply status for later analysis. Do you know how noisy your power lines are? Do you know the frequency and magnitude of sags and spikes that occur on your electrical power lines?

A UPS is a critical component of a data network. Remote monitoring software allows a network control analyst to monitor the status of each remote UPS and display the current line voltage and the voltage/current draw on the equipment. This helps to track which lines seem to have the most variation and potentially drive it back to a root cause in your facility. If some electrically driven machine in your facility is causing problems in your internal power grid, it needs to be identified and provided with better electrical isolation.

UPS TESTING

It is great to have a UPS system set up and running, but it needs to be tested if there is to be a credible plan. So, on a weekend in your slow time of the business cycle, you should plan for a UPS load test. This will demonstrate your power support system capabilities before a blackout strikes.

To set up the test, shut down the programs on all your computers but leave the computer running. The idea is to not lose any data but to still pull each system's normal electrical load. Bring in your UPS service technician to address issues

Armed and ready for the test. When management says yes, it's time to do a test. When all

This test has several goals:

1. You want to see what is not on the UPS that should be. Once the power is cut and the batteries are humming, you will see which server, computer, or network device has been overlooked. Now look to see which low-value items are connected and wasting valuable emergency power.
2. You need to know how well your UPS will support the load you have attached to it. If it is overloaded, you must plug some equipment into other power sources or get a bigger UPS unit.
3. When you shut down the servers' operating system, bring along a stopwatch and write down how long it takes. This will tell you the minimum amount of time the UPS must hold for you to perform orderly system shutdowns. If your servers are far apart in different rooms and the same person is expected to shut them all down, that may add travel time to the time you must allow on the UPS. Plan your time for the worst case.
4. Observe exactly what information the UPS displays about the remaining minutes of power, given the current consumption rate. Compare this information to the operator instructions you have provided to the after-hours support team. Be sure to also train the facility electricians on how to read the UPS display panel.
5. Exercise your power-shedding plan while someone observes the impact on the UPS. How much additional time do you get for each level shut off?

POWER GENERATORS

If your facility absolutely must maintain its power supply in the face of any sort of electrical problem, then you will need your own electrical generation system. This is a large leap in complexity above UPS systems and takes extensive planning. There are some industries that quickly come to mind as requiring this level of support. Hospitals need it to support electronic medical equipment, food storage sites need it to prevent spoilage, and even Internet hosting providers need it to ensure maximum application availability to their customers.

On the other hand, it is kind of nice to switch from having a problem to being in control of it. A properly sized and installed electrical generation system can return some benefits: It keeps your company running while other companies cope with a rolling blackout, allows you to potentially sell electrical power back to the utility company, and lets you run your generator during peak electrical usage times, thereby avoiding the highest cost electrical power.

SIZING YOUR GENERATOR

Once you decide the need for maximum power availability, you begin with determining what it is you need to support. If it is everything within a building or an isolated part of a building, you could contract for an electrician to monitor the amount of electricity used in that building (or part of the building) and use that as a starting point for sizing your equipment. If the generator is only supporting one portion of the facility, you must have a way to isolate it from the rest of the structure.

Next, you need to know how long your generators must provide electricity. If you live in an area that experiences widespread natural disasters, such as floods, hurricanes, earthquakes, or blizzards, then you might want to allow for running this system for several days at a time. A good place to start when planning on system size is to use your personal experience and knowledge about the frequency and length of outages in your area. This will help to determine the size of your fuel storage system for running the generator.

SWITCHING TIME

Some industries, like hospitals, have a standard amount of time they can be without electrical service. Their generator must switch on automatically. However, mechanical engines take some time to start and run up to operating speed. (Ever start your car on a cold day?) Some of the fastest generators can automatically sense the loss of electrical power and start providing standby power in less than 10 seconds.

The question here is how long of a gap your company can tolerate. During this brief outage, UPS systems can maintain power to critical devices. Some equipment, like refrigerators, can tolerate a brief gap since they are already chilled down. Some equipment, like lights, can ever so briefly be out if supported by a backup emergency lighting system. So, when deciding how long your company can function without electrical power, be very specific about what is needed and why.

The alternative is to always run generators together with pulling power from the power grid. As you can quickly discern, this is yet another step in complexity that distracts you from your core business. Rather than take this step, most companies settle for quick-switching generators supplemented with UPS support at critical points.

GENERATOR TESTING

More than any other power support system, the engines on your generators will take regular care. Begin by running them monthly to ensure they function on demand. Next, they need to be tested under load. This can be arranged for a weekend where every piece of equipment they are to support is turned on and the electricity disconnected for a few hours from the power grid. Periodic testing under load is a critical component of your power backup system credibility.

During your testing, monitor the actual fuel consumption to generate a given unit of power. Fuel consumption is also a matter of air temperature (height of summer or the depths of winter). Aside from the manufacturer's claim, use this test to determine how long your onsite fuel supply will last for delivering electricity.

Testing also exercises the people supporting your generators. By drilling them on their duties, they will be able to respond more quickly in a crisis. Be sure to rotate personnel to provide sufficient trained backup staff.

WORKING WITH YOUR PUBLIC UTILITY

Unlike a UPS or line conditioner, a generator has the potential to help pay for itself. During peak electrical usage periods, such as the depths of winter or the

days, you contribute to the overall containment of electrical rates. And even then the units don't need to run all day, just during the peak usage hours of the day. If your generation capability is sufficient to run your entire company site, then the utility may call you and ask that you run your generators at those times to reduce peak usage.

Another aspect of running your own generators is the selling of power back to the power utility. This must be investigated with your local board of public utilities to determine how much you would be paid and what conditions must be met. But if you are in an area of unreliable power, you might be able to address your own problems and cover some of your costs at the same time.

ENVIRONMENTAL AND REGULATORY ISSUES

Like all good things, there are some downsides. Running an internal combustion engine to make electricity puts pollution into the air. Some jurisdictions limit the number of hours per month that a generator can be run (except in a crisis). Before purchasing your generator, check for any requisite permits for such things as fuel storage, air pollution, and taxes.

ACTION STEPS FOR YOUR PLAN

If you have a UPS, be sure that it is properly maintained. Most UPS units require regular preventive maintenance, such as changing the air filters and checking the condition of the batteries. If you skip this step, then you are destined to discover how important it is the next time your UPS is needed.

Most large UPS units come with a small display panel that indicates the condition of the UPS's ability to supply power. Master this panel and all controls before an emergency arises. Never open the front of the UPS as the unit is an electrical shock hazard. The unit should only be opened by trained electricians.

In the event of a power outage, the front panel display can tell you how long the UPS batteries will be able to supply power to all the devices attached. This is a very important piece of information. Most computer servers take a long time to recover if they suddenly lose power. They require time to shut down "gracefully." You need to know the typical amount of time required to shut down each critical server.

Most UPS units include an audible alarm for when they are on battery power. It is important to know what these alarms are and what to do when you hear them. If the UPS units are in a place where a security guard can hear them after hours, be sure the guard knows what to do.

EMERGENCY LIGHTING

In a large building, it can get very dark very quickly in a blackout. Even if flashlights are readily available, you need to be able to find them. Also, a sudden blackout can be very disorienting to some people. This only adds an element of panic to the moment. To address this, most legal jurisdictions require the installation of emergency lights that come on whenever power to the building is lost. This provides some light for the safe evacuation of offices and workplaces.

These lights depend on a battery to power the lights in a blackout. To be sure that the lights and the battery are ready when they are needed, they must be checked monthly according to the manufacturer's testing steps.

SOMETHING EXTRA FOR YOUR SUPPORT PLAN

Following are three notices for you to consider as additions to your power support plan.

The first is an insert outlining your immediate steps. This notice should be kept at the help desk and posted on the computer room walls. When power drops, employees should execute the steps on this notice to contain the problem while the technical staff is called in.

The second is a wall notice on priorities—which equipment to turn off in what order so that your UPS and generator system can be freed to support the most critical systems.

The third is a set of instructions for making up the power shedding tags described on the Power Shedding Priorities page.

POWER OUTAGE ACTION PLAN	
1. IMMEDIATE ACTION	
a.	Notify your facility's Maintenance Supervisor immediately.
b.	Notify your Supervisor.
▶	Primary: (name and number here)_____
▶	Alternate: (name and number here)_____
c.	Determine the scope of the problem.
▶	Look outside the office. Is there power everywhere else in the building?
▶	Send someone outside to see if the electricity is on outside of the building. (Do not go yourself. You must sit by the phone to coordinate action until your supervisor arrives.) Are there lights on in any other buildings? Are traffic signals working? Are street lights on?
d.	Notify the facility's Disaster Recovery Manager.
e.	Begin a log sheet of all events to include when the lights went out, who was notified and when, any communications with the power company, etc.
2. PHYSICAL LAYOUT	
a.	UPS Room
▶	Send someone to look at the UPS. Note how long the display indicates

- Keep monitoring the UPS and continue shedding power using devices. When the UPS time falls below 20 minutes, begin shutting down all the servers.

- Call all system administrators and the network manager.

POWER SHEDDING PRIORITIES

When electrical power fails or when the power company notifies you that a failure is imminent, the drain on the UPS batteries is minimized by turning off equipment according to its power shedding priority. After reliable power is restored, turn equipment back on according to its priority. Start the most critical systems first.

When a power outage occurs or is anticipated, notify the Help Desk, Facility Security, your Supervisor, and the Data Processing Manager. Monitor the UPS systems to see how much time is remaining on the batteries (instructions are posted on the UPS devices).

This approach uses Power Shedding Priorities A through D, with A being least critical and D being most critical equipment to keep running. Priority is set according to:

- Which systems directly support facility production.
 - Which systems will cause widespread problems if they stop working.
 - Which systems are difficult to restart if they stop suddenly.
1. As soon as you lose electrical power, shut off nonessential systems and equipment identified with a green "A" power shedding label, such as CRTs, terminals, printers, card processing equipment.
 - Notify other company sites on your network.
 - Update the Help Desk, Security, and the Data Processing Manager.
 - When the UPS units show 15 minutes of power remaining, shut off low-priority CPUs and devices identified with a yellow "B" power shedding label. When you progress to this step:
 - Notify the Help Desk and the Data Processing Manager.
 2. When the UPS units show 5 minutes of power remaining, shut off all remaining equipment and servers identified with a red "C" power shedding label. When you progress to this step:
 - Notify the Help Desk and the Data Processing Manager.
 3. Let equipment identified with a tan "D" power shedding label "die" on its own as power drops off. This is equipment that can tolerate a sudden power drop.

Communication is important!

Ensure that management and the appropriate support people know when you start the next step of shutting down or restarting systems. Data Processing Management will call in the required system support people for a proper restart.

POWER SHEDDING TAG INSTRUCTIONS

Labeling your equipment: Make up labels on colored paper and then laminate them.

A = Green → B = Yellow → C = Red → D = Tan

Power Shedding Priority A	Power Shedding Priority B	Power Shedding Priority C	Power Shedding Priority D
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RESOURCES

Liebert—www.liebert.com (<http://www.liebert.com>)

American Power Conversion—www.apc.com (<http://www.apc.com>)

Tripp Lite—www.tripplite.com (<http://www.tripplite.com>)

Underwriters Laboratories—www.ul.com (<http://www.ul.com>)

CONCLUSION

Electricity is a powerful resource necessary to operate the modern business. As with any resource, you need to be familiar with its role in your operation and how its absence will affect your company. In the absence of clean power from the electric utility, the main sources of electrical power are a battery-operated UPS and a generator. A thorough understanding of the electrical requirements of your organization will help you to design the most cost-effective plan to protect against its absence.



PREV

15. Policies and Procedures: Get Everyone Moving in the Same Direction



NEXT

17. Telecommunications and Networking: Your Connection to the World