



## Preparing for electrical power interruptions

Pre-planning reduces business interruption risks.

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A blackout is a momentary or prolonged loss of power. A blackout can result in lost or corrupted data, failures of process control equipment, and loss of products or services. A brownout is a significant voltage reduction which results in similar problems. Both of these conditions can be considered power interruptions or outages. A power interruption can happen for any number of reasons and at any time of the day or year. Planning for this event, which will happen sooner or later, is key. What can you do to prepare for a power interruption?

### Know Your System

The first step is to become thoroughly familiar with the electrical system in your facility. Some electrical systems can be complex, that's why it's important to have updated electrical system documentation available. If you do not have one-line diagrams that accurately reflect the present configuration of your system, then step number one of your plan is to get them updated.

An effective one-line diagram will clearly show how the main components of the electrical system are connected, including redundant equipment and available spares. Details on equipment ratings are typically shown, and it is helpful to identify each major component with a unique name. In addition to showing the equipment identifier on the drawing, a permanent equipment label should be mounted onto the component itself. This greatly reduces the possibility of operating the wrong piece of equipment during an outage.

### **Critical Loads**

Once the design of the system is well documented and understood, it is important to identify critical loads that will require power in the event of a power outage. Typically, standby generation cannot be provided for all of the facility's loads, so decisions need to be made as to what equipment is absolutely essential during the outage. Once identified, these loads should be clearly marked on the one-line diagrams as being "critical loads."

Depending on the importance of the critical loads and the possibility of being without power for a given period of time, you may consider installing an uninterruptible power supply (UPS) and a permanent standby generator (with auto-start) to power certain equipment. It is imperative that the running load of each critical circuit (measured in amperes) be known so that you know what size generator(s) will be required. The kilowatt and voltage ratings of each generator needed should be readily available prior to the outage to expedite your response.

If portable generation is the best alternative for your facility, but purchasing a standby unit is impractical, you may want to arrange a rental agreement with a dependable

local vendor. Be sure to consider such things as how many generators they have in stock, how they will be delivered, what is the guaranteed response time, and what service is included if a generator has problems. Also, find out where you rank on their list of priority customers. When the outage happens, everyone will be looking for rental generators.

You need to plan how each generator will be connected during the outage. It is practical to install manual transfer switches near the critical panels ahead of time so they are available to easily transfer the load to the generators?

Are spare cables, properly sized for the load, stored with the generator(s) to ensure the hook-up can be done quickly?

Has the rotation of three phase circuits (if any) been pre-determined and labeled to ensure proper connection of the generator to the critical loads? Do you have formal written procedures explaining how to connect each generator to its emergency loads? Is the plan in accordance with all national and local electrical codes? Is your staff adequately trained to do this work? If not, make arrangements with an experienced, reliable contractor to provide these services.

Once you know your critical circuits and their corresponding generator ratings, you should develop testing procedures to ensure that the generators can carry the critical loads. The installed standby generators should be tested quarterly under actual load conditions. If this is not practical, at the very least each generator should be started and run for approximately 45 minutes each month. Make sure that generator testing meets all requirements for state and federal emissions

regulations. Also make sure that each generator fuel tank is full and that you know where and how to get fuel during the course of the outage. Test your fuel for the presence of water and replace fuel that is more than one year old.

If your facility has computer loads or communications systems that utilize a UPS to ride through short-term outages, you should develop procedures for having an orderly shutdown.

Typically, a UPS will provide power for only a short period of time (15 - 60 minutes) to allow you to back-up system and data files, and bring the systems down. Preparing for this scenario now, and performing practice runs, will enable smooth and decisive response during an extended outage and help avoid lost data.

### **Surge Protection**

Probably the greatest cause of damage to equipment from a power interruption is from the electrical surges that occur before, during and after a power interruption. By installing a surge protection device (SPD) on the incoming electrical service of a building, the damage caused by most externally generated surges can be greatly reduced. Further protection is achieved if SPDs are installed on distribution panels supplying critical or sensitive loads, and locally at the equipment itself. This layering of SPDs throughout a facility is known as a "Zone of Protection" approach, and is the most effective way of protecting your facility against electrical surges.

### **Loss of Telephone Service**

Telephone service interruptions affecting a significant geographical area usually do not result in property damage.





However, if interruption of communications would affect your business adversely, alternative communications should be considered.

### **Power Outage Procedures**

So far, we have focused on actions you can and should take before the power outage occurs. There is no doubt that proper planning in advance will make your response to an outage that much more effective. But what should you do when the outage occurs?

Having well-written, easily understood procedures that can be followed without confusion will facilitate a quick response when an outage occurs. Ensure that the electrical systems documentation is kept in a central location. The same goes for the list of standby generators, the loads to which they will be connected, and the step-by-step procedures on how to connect each portable generator.

Procedures should include steps for disconnecting or turning off all loads (even the loads that are not running when the power is out), as well as specific steps for bringing loads back on line when power is restored. This will limit the exposure of the equipment to electrical surges and may aid in controlling the facility's monthly electrical peak demand charges during restoration.

Start by simply turning electrical equipment to the OFF position. Next, open circuit breakers or disconnect switches to isolate equipment. Then, when power is restored, close circuit breakers and disconnect switches closest to the supply source first. Then close circuit breakers or turn on switches one at a time, working toward the load, until all of the equipment is energized and power is restored. This procedure also should be followed when connecting portable standby generators to critical loads. Make sure the circuit breakers and disconnect switches in the circuit are open before the generator is started. Then slowly close one breaker or switch at a time, working from the source (generator) to the load (equipment).