

The Locomotive

Preparing for an Electrical Power Outage

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Introduction

Blackout! The electric power supplying your business operation is out. You knew it could happen for any number of reasons and at any time of the day or year. Suddenly you wish you had planned for this event that you knew would happen sooner or later, but there was always something just as important that needed to be done immediately. Now it's scramble time, and the lights are out.

Whew! Good thing that was just a bad dream. In fact, today seems like the perfect day to begin putting together a plan that will minimize the risk to your business operation in the event of a power outage. But where do you start?

Know Your System

The first step in preparing a blackout response plan is to become thoroughly familiar with the electrical distribution system layout and design in your facility. However, most power systems are quite elaborate and complex, and it would be impractical to expect someone to commit a system design to memory — not to mention dangerous. That is why having updated system documentation is so important for anyone responsible for the operation of a power system, regardless of the size. 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



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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 emergency.

Critical Loads for Emergency Power

Once the design of the system is well documented and understood, it is important to identify critical loads that will require emergency power in the event of a power outage. Typically, emergency generation can not be provided for all of the facility's loads, so some 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 "emergency loads."

Ideally, all critical or emergency loads should be fed from common circuits, separate from non-emergency loads. This may require that some equipment be rewired to other circuits, but this will make it much easier to supply emergency generation during an outage

Once the emergency circuits have been established, you will need to be careful that future loads added to these circuits fit the criteria of being "critical." Very often, new loads are added to any electric panel that may have an open circuit breaker, regardless of its importance. This results in an "emergency" panel being loaded with non-critical equipment for which emergency generation during an outage is not necessary.

Emergency Generators

Depending on the tolerance of the emergency loads to being without power for a given period of time, you may consider installing a permanent emergency generator dedicated to that equipment, rather than rely on portable generators that need to be hooked-up after the power has gone out. It is imperative that the running load of each emergency 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.

Making Connections

You need to plan how each generator will be connected during the emergency response time. Is it practical to install manual transfer switches near the emergency 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 emergency generator(s) to ensure the hook-up can be done quickly? Has the rotation of three phase circuits been pre-determined and labeled to ensure proper connection of the generator to the emergency loads? Do you have formal written procedures explaining how to connect each generator to its emergency loads? Is your staff adequately trained to do this work? If not, make arrangements with an experienced, reliable contractor to provide these services.

Testing

Once you know your emergency circuits and their corresponding generator ratings, you should develop testing procedures to ensure that the generators can carry the emergency loads. Ideally, the 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.

Oh, and don't forget the fuel! 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. Replace fuel that is more than one year old.

Uninterruptible Power Supply (UPS)

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 shut down. 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 allow smooth sailing during an extended outage and help avoid lost data.

Surge Protection

Probably the greatest cause of damage to equipment from a power outage is from the electrical surge that is thrust through the system when the power first comes on. Fortunately, there is a way to protect against these phenomena, but very few businesses take the steps needed to achieve this protection.

By installing a surge protection device (SPD) on the incoming electrical service of a building, the damage caused by most externally generated surges (such as lightning or utility operations) 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, including lightning. For more information about surge protection call HSB's Fax-On-Demand service toll-free at 1-800-716-7874 and request document #431 — **Guidelines for Providing Surge Protection at Commercial, Institutional, and Industrial Facilities.**

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?



Again the answer lies in planning — in this case having well-written, easily understood procedures that can be followed without confusion. We already mentioned the need for updated one-line diagrams, but make sure they are kept in a central location with all of the other necessary documentation. The same goes for the list of emergency generators and the loads to which they will be connected. Having step-by-step procedures on how to connect each portable generator will save a great deal of time and stress come crunch time.

Finally, to help your SPDs protect your equipment, you should have a procedure for disconnecting or turning off loads (even though they are not running when the power is out). This will limit the equipment exposed to the surge when the power is restored.

Start by simply turning electrical equipment to the OFF position. Depending on your system configuration, you may need to 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.

Next, close in 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 emergency 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 in one breaker or switch at a time, working from the source (generator) to the load (equipment).

Careful pre-planning is the key to successfully reducing risk to your business caused by power interruption. Take steps today to protect your business from the adverse effects of power interruption.

[Editor's Note: This article is not meant to be exhaustive or complete, nor is it designed to replace information or instructions from the manufacturer of your equipment.]

About the Author

Matthew Glennon is a registered Professional Engineer in New Jersey with more than 14 years of experience in electric power engineering and construction. He is a magna cum laude graduate of Manhattan College where he earned a Bachelor of Engineering degree in electrical engineering. In addition, he holds a Master of Engineering degree in electric power engineering from Rensselaer Polytechnic Institute (RPI) in Troy, N.Y., and an MBA in Finance from Rutgers University. He is a member of IEEE, NFPA, and the National Society of Professional Engineers (NSPE), as well as a Correspondent to the National Academy of Forensic Engineers (NAFE).