Is Your Water or Wastewater System Prepared? What You Need to Know About Generators.

United States
Environmental Protection
Agency Mid-Atlantic
EPA 903-F-11-002
March 2011

Loss of electricity quickly becomes a major challenge during natural disasters and could raise public health concerns. Without backup power for an extended period, many water and wastewater services cannot be provided. However, as demonstrated during incidents such as hurricanes and ice storms, not all utilities are prepared to get their systems operational again. This brochure provides tools and prompts utilities to better prepare for emergency generator needs, provides tips on running and maintaining generators, and includes an easy-to-copy form to determine and document backup power needs.

How do I know what my backup power needs are?

1. Classify the electrical needs at your utility.

- *Critical need.* Equipment essential to maintain public health protection (e.g., pumps).
- *Secondary need.* Equipment that would enhance operation, but is not critical (e.g., SCADA components).
- *Noncritical need.* Equipment provided for convenience/comfort, but not essential (e.g., pumphouse lights).

Only consider needs critical to maintaining an acceptable level of service during power outages at your utility.

2. Identify the electrical equipment within the critical needs at your utility and determine their voltage, phase configuration, and horsepower/amperage requirements. Remember, electrical equipment starting power demands are usually two to three times higher than their running demands, which may dictate a larger generator. A licensed electrician can provide assistance in determining your backup power needs.

3. List all your critical electrical equipment and their starting order to determine your required starting power. At a minimum, your generator(s) must have the capacity to supply the maximum starting power demands and the running demands of the connected equipment.

4. Determine your generator needs. Make it easy by using the attached form.

"Having a backup generator is essential, but ours failed when we needed it most. It is critical to keep your generator maintained and to test it regularly under its operating load. Our lesson learned? Make sure you get to know your local emergency planners and have a plan for backup power."

- a water system operator

What other considerations are there?

1. Fuel Type - Fuel type greatly influences emergency generator(s) selection. Diesel generators are the most common, and offer the largest selection, availability, and power range (from 5 kilowatts [kW] to over 2,000 kW). To select an appropriate fuel supply, consider:

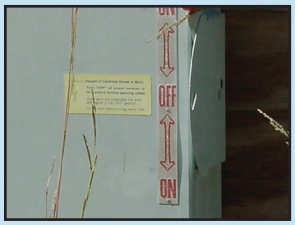
	Diesel[1]	Natural Gas[2]	Propane[3]	Gasoline
Fuel Storage	+	+	+	-
Fuel Delivery Method	-	+	-	-
Generator Availability	+	-	-	+
Generator Portability	-	-	-	+

[1] Assumes a consumption rate of 0.07 gallons per hour for every 1kW of power generated.
[2] Assumes access to a pipeline. Can use propane as a backup fuel, but requires an adapter.
[3] Use the generator specification sheet to calculate expected runtime for a given load and propane tank capacity.

Also check any local or state regulations regarding air quality, as these may affect the generator(s) you select.

2. Hook-Up Method - Generators do not simply plug into a piece of equipment that you would like to power. You have to install a connection that will enable you to rapidly hook up the generator to your well or sewer lift station pumps, and not accidently "backfeed" electricity into utility company lines, which could electrocute a line worker. Connection methods include transfer switches and camlocks.

Transfer switches can be either automatic or manual, and will let you easily switch back and forth between commercial and generator power sources. These switches are typically installed close to your main breaker box.



Transfer Switch

Camlocks are connectors that can be used to connect a generator directly to a critical piece of equipment, such as a pump at a wellhead or lift station.


Camlock

You will need a licensed electrician to help you determine which method is best for you and to assist with installation. A licensed electrician can also help you size the connector and ground cables.

3. Location - Emergency generators must be able to withstand climate extremes and be able to operate under all conditions. Things to consider when locating a generator at your utility include:

- *Environmental considerations.* It is important to prevent contamination of source water by fuel, and state requirements, such as containment measures, should be checked. Generators and their fuel storage tanks must be located above potential floodwater levels. Generators should also be protected by using a weatherproof enclosure. Check with your state for other requirements.

- *Siting considerations.* A flat surface (e.g., concrete slab) without obstacles is needed for a portable generator. In addition, be sure that the generator is in a well-lit or patrolled area to avoid theft and vandalism.

4. Other Options - For added flexibility, consider a variable frequency drive (VFD). The VFD is easy to operate, can convert single-phase power from small generators to three-phase power, and can supply power under a variety of horsepower demands. Small, portable generators that can be used with a VFD are readily available from the nearest hardware supplier. Consult your licensed electrician to see if a VFD is right for your utility.


VFD mounted in box

Should I purchase, rent, borrow, or share?

Many factors affect the decision to buy, rent, borrow, or share a generator(s). Funding, maintenance requirements, rental availability, and mutual aid and assistance agreements should all be considered. If you are sharing, who gets the generator first? It is probably easiest to make the decision by considering the advantages and disadvantages of having a generator onsite (purchase) versus obtaining a generator offsite (rent, borrow, or share).

The tables shown here highlight some of the advantages and disadvantages of each option.

Onsite Generator (Purchase)	
Advantages	***Disadvantages***
Immediate start-up during a power failure, as it's already at your utility and ready to go	Up-front capital investment could be costly
You are familiar with the generator and its operation	Long-term maintenance is required
Can be any size	A disaster that damages your plant may also damage your generator

Offsite Generator (Rent/Borrow/Share)	
Advantages	***Disadvantages***
No large up-front capital cost if rented, or, if purchase cost shared with other utilities	Travel time delays to get generator to your site, especially if roads are impassable
Flexibility in where you get it from, could have multiple sources	May require special equipment (e.g., crane) and extra personnel (e.g., electrician) to install
Shared (or no) long-term maintenance costs	In a large incident, may be hard to locate a generator due to competing demands

Unique circumstances at your utility will ultimately determine whether purchasing, renting, borrowing, or sharing a generator will work best. Regardless, once you have determined your backup power needs, you should communicate those needs to your Local Emergency Planning Committee (LEPC) or emergency management director. This allows them to be aware of the generator resources that you already have (if any) and what generator resources you will need during a power emergency, and any priority public health aspects related to power loss.

Operation and Maintenance Tips

- Exercise your generator periodically under the actual electrical load required of the unit to keep it ready for use.
- Develop a "start and connect" checklist specific to each individual generator and keep it where staff can easily find it.
- Do not operate the generator in excess of its rated capacity.
- Be sure the generator is properly grounded.
- Keep portable generators outside and at least 10 feet away and downwind from inhabited, enclosed areas to prevent the buildup of carbon monoxide fumes.
- Maintain 3 to 4 feet of clear space on all sides and above a generator for adequate ventilation.
- Perform scheduled maintenance as recommended by the generator manufacturer.
- Incorporate fuel management into the maintenance schedule to ensure availability of clean, reliable fuel.
- Do not refuel the generator while it is running, turn it off first and let it cool, especially if the generator uses gasoline.
- Keep the generator dry by keeping it elevated and away from possible flooding.
- Support electrical cords off the ground and do not let cords run through low-lying areas or puddles.
- Replace any cords with damaged insulation.
- Train all staff on how to operate the generator safely.
- Wear hearing protection if you have to work close to a generator.

Where can I go to find out more about generators?

Emergency Response Portal, U.S. Army Corps of Engineers (USACE) https://eportal.usace.army.mil/sites/ENGLink/EmergencyPower/default.aspx	Information sharing tool to build federal, state and local capabilities to respond to disasters. Contains links to documents on Standard Operating Procedures of the Temporary Emergency Power Mission.
Electrical Generating Systems Association (EGSA) http://www.egsa.org/index.cfm	Association dedicated to on-site power generation that includes over 500 companies that make, sell, distribute, and use onsite power generation technology and equipment.
Water & Wastewater Mutual Aid & Assistance Resource Typing Manual http://www.nationalwarn.org	This manual provides guidance to water and wastewater utilities when they request and provide mutual aid and assistance resources (such as generators) during and after an emergency.
OSHA Hurricane Safety Tips http://www.osha.gov/pls/publications/publication.athruz?pType=Industry&pID=107	Although dedicated to hurricanes, this site contains many safety tips regarding generator usage and other topics that are common to all disasters.
FlaWARN Best Management Practices For Water and Wastewater Systems http://www.flawarn.org/Documents/BMPs.pdf	Guidance document produced by the Florida WARN including Best Management Practices for water facility emergency preparedness and response.

"When the power went out, we couldn't pump and pressurize our system. But we are a small utility, and can't afford a generator. We joined the WARN as one way to locate a generator the next time we need one."
- a water supplier

Who can I contact in my state?

Call your consulting engineer or licensed electrician if you have specific questions regarding a generator(s) at your utility. Each utility is unique in its critical treament processes and its design, and you will want your own experts to help you answer any questions you may have regarding backup power generation. Also, check with your state drinking water primacy agency to see what (if any) generator or fuel storage requirements there are for utilities in your state.

TIP: Joining a Water/Wastewater Agency Response Network (WARN) is one way to borrow or share generators.

www.dewarn.org
www.mdwarn.org
www.ncrwarn.org
www.pawarn.org
www.vawarn.org
www.wvwarn.org

EMERGENCY GENERATOR INFORMATION FORM – Side 1 (complete prior to an emergency)

Instructions – Side 1

- Get a licensed electrician to help complete this form.
- Fill out a copy of the form for each generator location.
- Store copy in multiple safe places (ERP, truck, offsite file).
- Share the form with LEPC, WARN or state primacy agency.
- Update form periodically.

Contact Information

Name: _____

Title: _____

Day Phone: _____

Emerg. Phone: _____

System Name: _____ PWS ID#: _____
Street Address, City, and State: _____
Max Day Demand (MGD*): _____ Avg. Daily Demand (MGD*) _____
** Million Gallons per Day*

Critical Utility Electrical Needs: (copy form as necessary)

Location (Name/#): _____
Location (Name/#): _____
Location (Name/#): _____

Generator Needs: (copy form as necessary)

Location (Name/#): _____
Existing transfer switch: Yes___ No___; Existing 'add-a-phase' or 'roto-phase' unit: Yes___ No___
(These units convert a single phase line to a three-phase line)
Size of electrical main breaker: _____ Amps
System Voltage: 240 volt single phase _____ 240 volt three phase _____
208 volt three phase _____ 480 volt three phase _____
Major motors, in starting order, used for facility operations:
(example: 75 HP 2 Quantity 460 Volts 3 Phase)
___ HP ___ Quantity ___ Volts ___ Phase
___ HP ___ Quantity ___ Volts ___ Phase
___ HP ___ Quantity ___ Volts ___ Phase
___ HP ___ Quantity ___ Volts ___ Phase

Note: at a minimum, a generator must have capacity to supply maximum starting power demands and running demands of connected electrical equipment.

Existing concrete pad to locate generator? Yes___ No___ Distance of pad to connection point: _____
System meter kilowatt reading: _____
Generator Type (from AWWA Water & Wastewater Mutual Aid & Assistance Resource Typing Manual):

_____

Additional comments: _____

_____

_____

EMERGENCY GENERATOR INFORMATION FORM – Side 2 (complete prior to an emergency)

Instructions – Side 2

- Get a licensed electrician to help complete this form.
- Fill out a copy of the form for each generator location.
- Store copy in multiple safe places (ERP, truck, offsite file).
- Share the form with LEPC, WARN or state primacy agency.
- Update form periodically.

Contact Information

Name: _____

Title: _____

Day Phone: _____

Emerg. Phone: _____

System Name: _____ PWS ID#: _____
Street Address, City, and State: _____
Max Day Demand (MGD*): _____ Avg. Daily Demand (MGD*) _____
* *Million Gallons per Day*

Existing Generators: (copy form as necessary)

On-site generator location (name/#): _____
Is on-site generator portable? Yes____ No____
If facility has an off-site generator ready for use in an emergency, what is the source/location of the generator? _____
Existing transfer switch: Yes____ No____ AND, if yes, is switch manual? ____ or automatic? _____
If automatic, what brand is the switch and how many wires are required to start? _____
_____
Size of generator: _____kilo Volt Amperes (kVA)_____kilowatts (kW)
Configuration: (Wye or Delta): _____ (A Wye configuration is in the shape of a "Y", and a Delta configuration is in the shape of the Greek letter delta "Δ", a triangle)
Load cable length:_____ Feet Load cable size:_____Thousand Circular Mils (MCM)
or _____ American Wire Gauge (AWG)
Ground cable length: _____ Feet Ground cable size: _____(MCM or AWG)
Generator connection point: _____ Fuel tank size: _____
Fuel type: diesel_____ natural gas_____ propane gas_____ gasoline_____ other_____
Fuel available on-site? Yes_____ No _____ If yes, how much?_____ How stored?_____
_____
Who provides generator maintenance and testing service? _____
What is the testing cycle and last test date? _____
Does utility have access to an electrician? Yes____ No____ # of power company transformers: _____
Transformer size(s) painted on front of the unit(s): kVA _____ kVA _____ kVA _____ kVA _____
Generator Type (from AWWA Water & Wastewater Mutual Aid & Assistance Resource Typing Manual):

System is WARN member and willing to list as an available WARN resource? ____Yes _____No
_____
Additional comments: _____
_____
_____
_____