Tillamook
People's Utility District

Directors
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A Customer-Owned Electric Utility Office: 503 842-2535 • Toll-free: 800 422-2535 • Fax: 503 842-4161 www.tpud.org

Patrick F. Ashby
GENERAL MANAGER

WHEN THE POWER GOES OUT...

→ Turn off all lights and appliances.

→ Most central heating systems use electricity and will not operate during a power outage.

→ To conserve existing heat within the home, concentrate your activities in one or two adjacent rooms. Keep these areas isolated by closing doors or handing blankets over doorways.

→ Food in refrigerators and freezers may be safe to eat for up to 24 hours. Don't open refrigerators or freezers any more than needed to remove items. When power is restored, you may need to completely defrost the freezer and throw away any items that may have been thawed too long.

→ Most electric water heaters will keep water warm for 6-12 hours or more.

→ Although most wood or gas fireplaces are inefficient, they may be used to heat the space where they are located.

→ Although you may be tempted to heat your house in an emergency with a gas cooking range, they can discharge large amounts of odorless, deadly carbon monoxide.

→ Portable kerosene heaters and camping propane heaters may also seem like a good choice, but they are strongly discouraged. Because they are not vented outside, they exhaust all fumes and large amounts of moisture into the room.

COPING WITH POWER FAILURES

Extension Miscellaneous 8734 • April 1999

When the electricity goes out, candles and flashlights can be fun for a few hours. In the event the power is out for a longer period, being prepared for emergency heating and lighting can make a difficult situation easier.

Your options for coping with a power failure depend on how cold it is outside, how long you're without power, and whether you have equipment that can meet your needs without external power sources. This publication will help you make decisions to prepare for short- or long-term power failures.

Planning Ahead

You can lessen the impact of a power failure by weatherizing your home to reduce its energy requirements and by installing energy equipment that operates independently of external supplies.

It's a good idea to store flashlights, extra batteries, candles, and candle holders in a convenient place that you can easily find in the dark.

A well insulated and air sealed house can hold heat and remain comfortable for 12 hours or longer. To be sure your home is prepared for power failures, take advantage of a free energy audit provided by your utility or fuel provider. Then work to implement as many recommendations as possible.

Most natural gas water heaters will continue to work without electricity, so you should have hot water during a power failure. Most electric water heaters will keep water warm for 6–12 or more hours depending on location.

Most central heating systems use electricity and will not operate during a power outage. You may be able to connect a portable generator or inverter to a gas or oil furnace or boiler and heat as usual (see *Portable Generators).*

Although most wood or gas fireplaces are inefficient, they may be used to heat the space where they are located. If your house has a wood stove, you probably already know how well it warms your home. Be sure to have enough dry firewood on hand for an emergency.

If your home doesn't have a fireplace or wood stove, you may want to consider installing a space heater that can be used during a power failure. Heaters are available that operate on wood, pellets, natural gas, propane, kerosene, or heating oil. One factor in your choice among these options should be how you would like to use the heater in normal conditions, not only during power failures.

For details on various space heater options, see *Keeping Warm.*

When the Power Goes Out

After the power goes out, turn off all lights and appliances. Equipment that operates with a remote (instant on), contains electric clocks, or is always running, has an "active" connection to the grid and can be damaged if there is a power surge or voltage drop (sag) when power is restored. To protect such appliances, you may want to unplug them.

To conserve existing heat within the home, concentrate your activities in one or two adjacent rooms. Keep these areas isolated from the rest of the house by closing doors or hanging blankets over doorways. The kitchen and an adjoining room usually are good choices during a power outage.

Food in refrigerators and freezers may be safe to eat for up to 24 hours. Do not open refrigerators or freezers any more than needed to remove items. When power is restored, you may need to completely defrost the freezer and throw away any items that may have been thawed for too long. Check with your local county office of the OSU Extension Service for more information about food safety.

Although you may be tempted to heat your house in an emergency with a gas cooking range, these are designed for short-term cooking situations and

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David Brook, Extension agent, Multnomah County, Oregon State University

OREGON STATE UNIVERSITY EXTENSION SERVICE

can discharge large amounts of odorless, deadly carbon monoxide. They also release substantial amounts of moisture into the air that can lead to mold and condensation problems.

Portable kerosene heaters and camping propane heaters also may seem like a natural choice for emergency heat, but they are strongly discouraged. Because they are not vented outside, camping heaters and portable kerosene heaters exhaust all fumes and large amounts of moisture into the room. Opening a window slightly for fresh air, as recommended by manufacturers, still may not provide adequate ventilation.

If you use any fuel-burning device in your house, be sure you also have an operating battery-powered carbon monoxide alarm to alert you to dangerous situations. If the alarm sounds, shut off the heater, evacuate everyone out of the house, and open windows for ventilation. After an alarm, do not use the fuel-burning device until it has been checked by a licensed technician.

Extended Power Outages

If the utility company announces your area may be without power for several days, your best choice may be to move in temporarily with friends or relatives in another part of town not affected by the power outage.

Keeping Warm with Room Heaters

Some new wood stoves and space heaters vented to the outside are very efficient. If you are considering the purchase of a room heater, consider the following

Fireplaces. Existing open fireplaces, even those with glass doors or air circulating fans, are poor space heaters although they may be useful in an emergency. If you haven't had your chimney inspected, now is a good time. Mortar may be loose or missing, which can lead to fires if the chimney is used constantly for several days.

Gas logs. If you don't want to haul wood, the least expensive alternative is to install artificial "gas logs" in an existing wood-burning fireplace. Like wood-burning fireplaces, they primarily are decorative but may be able to heat one room in an emergency.

Wood stoves. All new wood stoves must be tested and certified by the U.S. Environmental Protection Agency (EPA). The cleanest burning and most efficient have an "EPA Phase II certified" rating. Although used wood stoves without EPA (or Oregon DEQ) ratings are available, they are not as clean burning and are a poor choice for regular use. No matter what kind of wood stove you purchase, be sure your local fire department inspects the chimney and stove installation. Otherwise your homeowner's insurance may not provide coverage in the event of a fire. You also should have a supply of dry (at least 6 months old) firewood because wood may be difficult to obtain in an emergency.

Pellet stoves. Some people consider pellet stoves more convenient than wood stoves because the pellets automatically feed into the combustion chamber as needed. Pellet stoves burn very efficiently. Most are vented through an outside wall and do not require a chimney to the roof. Since most pellet stoves have fans and electric controls, be sure the model you're considering can operate during a power failure.

Vented natural gas, propane, or oil fireplaces or inserts. Most vented gas fireplaces are designed as "decorative devices" but may be useful for heating in an emergency. The more efficient models have a yellow EnergyGuide efficiency label indicating they are rated as space heaters. Some models are "direct vented" through an outside wall, simplifying installation if installing a chimney is a problem. Avoid models with pilot lights because they waste considerable energy when not in use. Verify that the models you are considering can be lit manually during a power failure. Some oil dealers carry an oil fireplace with visible flame.

Vented natural gas, propane, kerosene, or oil heaters. These "stoves" do not have a visible fire but have a fan to circulate heat. Some are "direct vented," which simplifies installation. Verify that the models you are considering can operate during a power failure. A few high efficiency models are available that use gas/propane, kerosene, or #1 heating oil.

Unvented natural gas or propane fireplace heaters. Although legal in Oregon, most health experts do not recommend unvented or "vent-free" gas fireplaces in residences. Because they have no chimney or vent to the outside, these heaters release potentially dangerous combustion byproducts into the room. Continuous use can introduce substantial amounts of humidity into a room causing condensation and mold problems.

COPING WITH **POWER FAILURES**

If temperatures are below freezing, drain the plumbing system to help avoid frozen pipes. Turn off the incoming water at the main water valve. Open all water faucets in the house including showers and hose connections on appliances. Be sure water drains from a faucet at the lowest level in or outside the house. Shut off power or gas to the water heater and drain it as well.

When heat is restored to the house and pipes begin to thaw, check for cracks and breaks and listen for concealed leaks.

Portable generators

Using a portable generator during a power outage can be a convenient way to keep your house comfortable and maintain a somewhat normal lifestyle. Portable generators are sold at home hardware stores, home centers, and outdoor supply stores. Prices range from $150 for small units that can power several light bulbs to more than $1,000 for whole-house units. Some models have automatic electric starting capability. Better generators have an automatic shutdown if the crankcase oil is low. Larger generators can produce both 120 volt AC (standard line power) and 220 or 240 volt AC for larger appliances.

You can determine what capacity generator you need by comparing the wattage rating of the generator to the wattage of lights and appliances you intend to operate (see *Calculating Generator Size*). Depending on fuel tank size, a generator may be able to operate for 2–10 hours between refueling.

A portable generator can operate a gas or oil furnace during a power outage. You may need to hire an electrician if the furnace is "hard wired" rather than with a plug-in connection. Most generators do not have sufficient capacity to operate heat pumps, electric furnaces, electric baseboard heaters, or electric water heaters.

Do not plug a generator into an electrical outlet to feed power into your house wiring. Besides being illegal in Oregon, the generator can feed electricity back through the utility power lines and possibly electrocute those working to repair the power outage. It's also likely you will overload the generator.

Connecting to a portable generator can be safely done two ways:

- Direct hookup using extension cords to connect to lights and appliances. Use only heavy duty orange or yellow extension cords with adequate capacity to handle the wattage. Do not connect more wattage than the continuous duty rating of the generator (the generator will slow down when it's overloaded). See the table included in this publication to determine the correct extension cord to use.
- Permanent connection using a transfer switch. This provides a safe way to connect a generator and usually is installed by an electrician. It assures that no power from the generator can reach the grid. Because most people do not want to power their entire house, the transfer switch usually controls a sub-panel, which feeds a few circuits for lights, outlets, and critical appliances throughout the house. Be sure the transfer switch and all wiring meets requirements of your local building department and the National Electrical Code (NEC). Manual and automatic transfer switches for use with electric start generators are available.

Locate the generator outside so exhaust fumes do not enter the house or attached garage. Follow all safety instructions included with the generator.

If you hear the motor slow down while using the generator, it means the generator is overloaded. If a generator is overloaded for prolonged periods, it will overheat and shut down.

12-volt inverters

If you want to operate a few lights or small appliances, another possible power source is a small inverter connected to a storage battery. An inverter changes 12 volt DC power from a storage battery to 110 volt AC power used by lights and appliances.

Compact inverters are sold at hardware stores, home centers, and outdoor and electronic stores. Inverters are designed to plug into a cigarette lighter of a vehicle or to be connected to a deep cycle storage battery (those used for boats, recreational vehicles, and electric golf carts). Depending on the capacity of the storage battery and the wattage of what you're trying to operate, inverters can provide power for several hours to 1 day.

To maintain the life of a storage battery, no more than 50 percent of the rated capacity should be used before recharging it. Plug lights or appliances directly into the inverter or select the proper sized extension cord.

Using fluorescent lights with an inverter provides more hours of operation since they consume less energy than incandescent lamps. An overloaded inverter automatically will shut off from overheating.

A storage battery can be recharged with jumper cables using an automobile alternator. If you use a non-sealed battery indoors, be sure to remember it is filled with corrosive, toxic acid and is very dangerous. Sealed batteries provide more protection.

If you plug an inverter into the cigarette lighter of a car, do not use it for more than a few hours before starting the car to recharge the battery. Car batteries are designed to provide high power for short time periods, not the slow, deep discharge needed for emergency power sources.

Calculating Generator Size

The capacity of a generator or inverter is usually listed in watts. Many appliances are rated in amps listed on a specification plate on the back or bottom of the appliance. Keep in mind that motors, such as those used to operate a refrigerator or freezer compressor, take about three times more power (watts) to start up than to keep running. Most generators or inverters list both their continuous and temporary overload capacity.

The Ohms law formula converts watts and amps: Watts = Amps x Volts. For example: the blower on a gas room heater is rated 0.3 amp. What is the wattage? (The following calculation assumes the typical house voltage of 120 volts.)

0.3 amp x 120 volt = 36 watts

Start-up Power
3 x 36 watts = 108 watts temporary "overload"

Storage Battery Capacity
To determine how long a battery can power a light or appliance using an AC power inverter, you need to know the rated amp-hour capacity of the battery (this is not the "cold cranking amp" rating of automotive batteries). Use the Ohms law formula above to figure this example.

For example, a deep cycle 12-volt storage battery is rated for 50 amp-hours. Using a small inverter, about how long could it power the 36-watt blower from the above example:

50 amp-hours x 50% rate capacity = 25 amp-hours useful battery capacity
25 amp-hours x 12 volts = 300 watt-hours battery capacity
300 watt-hours/36 watts = 8.3 hours of continuous power

Recommended Extension Cords for Use with Generators

It's important to use extension cords of adequate current-carrying capacity when using a generator to operate electric equipment. Undersized cords result in excessive voltage drops and additional generator loading. This also can lead to reduced performance of the electric equipment.

Wire Gauge for Various Extension Cord Lengths

Watts	50 ft	100 ft	150 ft
240	18 ga.	18 ga.	18 ga.
480	16	16	16
720	16	16	14
960	16	14	–
1,680	14	12	–
2,000	12	12	–

For more Information

Oregon Energy Line. The OSU Extension Energy Program provides detailed information on home weatherization and energy efficiency. Call 1-800-457-9394 for a list of publications.

Oregon State University Extension Service. The OSU Extension Service has a variety of publications and videos. Visit your local county office (listed in local phone books under "county government") for a copy of their catalog or browse "Publications & videos" on the Web: http://eesc.orst.edu/agcomwebfile/edmat/

Utility weatherization programs. Call the utility that provides your heating fuel (or the State Home Oil Weatherization Program for oil and propane heated homes) for a free energy audit to determine the best steps to weatherize your home. Call 1-800-452-8660.

American Red Cross. Order a copy of *Before Disaster Strikes* by sending a self-addressed, stamped, business-sized envelope to the American Red Cross, Community Relations, P.O. Box 3200, Portland, OR 97208; or visit their Web site: http://www.redcross.org/disaster/index.html

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PORTABLE GENERATORS

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→ Connecting to a portable generator can be safely done two ways:

- Direct hookup using extension cords to connect to lights and appliances. Use only heavy duty orange or yellow extension cords with adequate capacity to handle the wattage.

- Permanent connection using a transfer switch. This provides a safe way to connect a generator and usually is installed by an electrician. It assures that no power from the generator can reach the grid.

→ Locate the generator outside so exhaust fumes do not enter the house or attached garage. Follow all safety instructions included with the generator.

→ If you hear the motor slow down while using the generator, it means the generator is overloaded. If a generator is overloaded for prolonged periods, it will overheat and shut down.

→ Most generators do not have sufficient capacity to operate heat pumps, electric furnaces, electric baseboard heaters or electric water heaters.

Frequently Asked Generator Questions

1. What size generator do I need?

This depends on the number and size of the loads that you want to run at the same time. If a house uses natural gas (or propane) for heat and hot water, a 4,000 to 6,000 watt generator can maintain a high level of comfort (assuming natural gas or propane is available). A house using an electric furnace and electric water heat may need a generator in the 20,000 - 35,000 watt range.

Generator size can be estimated by determining the major loads to be supplied and allowing some overhead for convenience appliances (television, computer, etc). Some of the most common major loads are listed below (these are average numbers and can vary):

Furnace blower motor (propane/natural gas heat):	1,500-2,000 watts
Refrigerator/freezer	1,500-2,000 watts
Well pump (1 horsepower)	3,500-5,000 watts
Water heater (electric)	4,000-5,000 watts
Electric furnace	11,000+
Heat pump	10,000+

By manually switching loads off and on the owner can ensure that only one major load is running at a time. This then allows a smaller generator to be used.

2. What is a manual transfer switch?

A manual transfer switch is a panel wired into the house electrical distribution system that allows a generator to be used to supply power. It prevents the generator from back-feeding the utility and reduces the potential for lineman injury.

3. How do I connect my loads directly to a generator?

The simplest and lowest cost method is to run extension cords from the generator to the loads to be supplied, i.e. refrigerator, freezer, lamps, space heaters, etc. A properly sized extension cord must be used when connecting loads to the generator.

4. How do I connect a generator to my house?

When a generator is to be connected to household wiring, an approved method of isolating the house electrical system from the utility must be used. **THE MAIN BREAKER OF THE HOUSEHOLD PANEL IS NOT AN APPROVED DISCONNECT DEVICE. NEVER CONNECT A GENERATOR TO HOUSEHOLD WIRING BY EXTENSION CORDS.** A manual or automatic transfer switch must be wired into the distribution system to allow the use of existing household wiring and receptacles. This is to prevent the generator from back-feeding and injuring line workers trying to restore power. Significant damage can result from the generator being on-line when utility power is restored.

5. **How must does it cost to install a manual transfer switch?**

This can vary depending on many factors. Typical installations are between $400 - $800 for a surface mounted switch located near the main distribution panel. Most transfer switches come with clear documentation and can be installed by the owner for the cost of a permit in a couple hours. Some factors that can affect cost:

- **Distance from the contractor:** Travel time and mileage costs money. The farther you are from the contractor the higher the cost.
- **Type of transfer switch:** Transfer switches come in a variety of makes, models and sizes. They can be surface mounted, flush mounted, or designed for outdoor use.
- **Type of installation:** Surface mounted switches take less time to install than flush mounted switches, resulting in a lower cost of installation.
- **Distance from the main panel:** Most manual transfer switches are designed to be installed within a couple of feet of the main panel. Additional materials and labor would be necessary to install the switch away from the main panel and would raise the installation cost.
- **Remote generator receptacles:** Most manual transfer switches have a receptacle to allow the generator to be plugged in to. In some cases it is more convenient to have the receptacle located closer to where the generator will be located when it is running.
- **Load identification:** In most cases the manual transfer switch will not be supplying all of the circuits on the main panel. The more time the electrical contractor spends identifying the circuits to be connected, the higher the installation cost.

6. **Can I open my main disconnect breakers and connect my generator to a receptacle?**

No. It is not allowed for the following reasons:

- The national electric code and most city, state, and county ordinances require approved means of isolating generator power from utility power. These requirements are designed to protect the lives of both you and the utility workers and to protect your equipment.
- The main disconnect breakers are not designed to isolate power from two sources.
- The main disconnect breakers can fail without visible indication. The breaker may feel l like it is open but may be electrically connected internally due to a spring or other failure. This can go unnoticed until utility power returns.
- When both sources of power are available it is possible to connect both sources together. Accidentally operating the wrong breaker can have severe consequences. Approved means of isolation usually require 3-position switches or breakers that prevent connecting both sources of power.

7. What type of fuel is best?

This depends on many factors - shelf life, cost, storage locations, availability, etc. See question #8 for more information on the different fuels.

8. What are the advantages and disadvantages of the different fuel types?

Gasoline

Advantages:

- Common fuel source – easily obtained
- Increases portability of smaller generators

Disadvantages:

- Highly flammable
- Short shelf life (approximately 12 months)
- Storing large quantities is hazardous
- May not be available during power outages

Propane

Advantages:

- Long shelf life
- Clean burning
- Easily stored in both large tanks or in smaller 5 - 10 gallon cylinders
- Obtainable during localized power outages - suppliers may be unable to pump fuel during widespread outages
- Home delivery available for larger tanks

Disadvantages:

- Pressurized cylinder of flammable gas
- Fuel system is more complicated (increased possibility of failure)
- Larger tanks are not aesthetically pleasing (unsightly)
- Fuel system plumbing results in higher installation cost

Diesel

Advantages:

- Least flammable fuel source
- Easily obtained
- On-site fuel delivery available

Disadvantages:

- 18 - 24 month shelf life
- Installing large storage tanks raises cost of system
- May not be available during power outages

9. **What size propane tank do I need to run my portable generator?**

That depends on a couple of factors. Larger tanks offer longer run times between refueling and on-site delivery of fuel may be available for tanks larger than 100 gallons. Small tanks like those used on barbecue grills allow several hours of operation and are easy to transport for filling at fuel stations.

10. **How long will a generator run on a tank of fuel?**

This depends on the size of the tank and amount of load on the generator. Higher loads require more fuel. A conservative rule of thumb is 1 gallon of fuel per hour for a 5,000 watt generator.

Propane fueled portables use a slightly larger amount of fuel than their gasoline counterparts.

11. **How long can a generator be continuously operated?**

Unfortunately, there is no set answer for this question. Most portables are designed for long life, heavy duty operation, and long run times. Gasoline units should be shut down during refueling to reduce the potential for starting a fire by spilling gasoline on hot exhaust components. The oil level should be checked and the unit inspected for signs of fatigue or abnormalities (cracked receptacles, etc) before restarting.

12. **How often should I shut the generator down?**

The answer to this question is similar to #11. Generators should be shut down and inspected daily or when refueling. If long periods of no load or light load operation are expected (such as during the night when everyone is sleeping) the generator could be shut down to extend the useful life of the generator and reduce fuel costs.

13. **Is it possible to run my portable in the garage?**

This is not recommended. Portable generators are designed for outdoor use. Running them indoors presents the following problems:

- Increased risk of carbon monoxide being admitted to living spaces.
- Potential for fire. Garages can have combustible material near the generator that can catch fire when in contact with hot exhaust components.
- Potential equipment damage. Indoor operation of the generator may restrict cooling airflow to the engine.

14. **Is it okay to build an enclosure around my portable generator?**

Yes, as long as the generator is taken out of the enclosure prior to operating it. Access to cooling air is vital to the proper operation of the engine. Portable generators do not have large cooling fans and are unable to circulate air in confined spaces. They rely on the natural circulation of heat resulting when the hot air rises away from the engine and is replaced by cool air.

15. How large a pump can a portable generator start?

When starting loads on a portable generator, the larger loads should be started first. A 4,000 watt portable can easily start a one horsepower pump. The 5,000 and 6,000 watt generators are capable of starting up to a 3 horsepower pump.

GENERATOR SALES/ELECTRICAL CONTRACTORS

BORLAND COASTAL ELECTRIC
PO Box 2697
Gearhart, OR 97138
503.738.8391
1.800.426.0018
CCB# 3226

CUMMINS NORTHWEST, INC.
4711 N. Basin Avenue
Portland, OR 97208
1.800.283.0336

E.C. WADSWORTH ELECTRIC
PO Box 3318
Bay City, OR 97107
503.377.2154
CCB# 49737

VAN LOO ELECTRIC
2 North Main Avenue
Tillamook, OR 97141
503.815.8145
CCB# 171850

These contractors have agreed to respond quickly to PUD customers interested in installing backup generators. However, any qualified electrician is capable of installing the transfer switch.

Load Calculation Work Sheet

EQUIPMENT	STARTING LOAD	AVERAGE WATTS	TOTAL
Clothes dryer (electric)		4,800	
Clothes dryer (gas)		500	
Coffee maker		600 - 1,200	
Computer		500	
Copy machine		1,500	
Dishwasher		1,200	
Electric blanket		150	
Fax machine		220	
Freezer	2,250	750	
Garage door opener		350	
Hair dryer		1000	
Heat (electric)		6 - 20,000	
Heat pump		10,000 +	
Lighting (100 watt bulb)		100	
Microwave oven		600 - 1,000	
Pellet stove		250	
Radio		50	
Range (each burner)		1,500	
Refrigerator/Freezer	1,800	600 - 750	
Septic pump	2,000	1,000	
Slow cooker		75	
Sump pump	1,500	750	
Television		150 – 500	
Toaster		1,200	
VCR		30	
Vacuum cleaner		600	
Waffle iron		1,200	
Washing machine	1,000	500	
Water heater (electric)		4,800	
Well pump (1 hp)	4,000	1,000	