



CITY OF SAUSALITO

DISASTER PREPAREDNESS – EMERGENCY OPERATIONS PROGRAM

“Preparing and Protecting our Community”

LIGHTING, POWER, AND HEATING DURING BLACKOUTS

Electrical blackouts do not just shut down your lights and television. They are serious technological emergencies that disrupt communications, transportation, medical services, food storage, and more. A large disaster can shut down power for long periods of time. If you want the ability to comfortably ride out blackouts, you will need safe, reliable, and relatively inexpensive emergency lighting and power generation equipment.

Lighting

Keeping lights on during power outages is a relatively simple task. All you need is a reliable source of light along with a power source. The best and easiest method is to use an electric camping lantern. This lantern is durable, can be moved around, and can burn continuously for periods of four hours or longer.

Some manufacturers provide battery powered lanterns. Some of these battery powered lanterns even have AM-FM radios with a hand crank that can be used to recharge its battery or power during operation. If you do purchase a lantern, always remember to buy extra fluorescent light bulbs.

The batteries that you choose are equally important. Rechargeable types are best. They are costlier than ordinary disposable batteries, but they are indispensable during emergencies because they allow you to reuse them hundreds of times. If you use rechargeable batteries in your flashlights or radios, you need two sets per each device. This will allow you to recharge each set by rotating them after use. Make certain that the second set is fully charged.

The next item on your emergency lighting list should be a solar battery charger. This will allow you to keep the batteries fully powered. Many different manufacturers offer solar battery chargers, please do your research and obtain the best charger that you can afford.

An alternative option for emergency lighting is kerosene or butane powered lanterns. Their only drawback is that they need flammable fuel to operate, but otherwise they are good options. There are many good brands of kerosene and gas lanterns so do your research and buy the best one that you can afford. Electric powered lights are preferred to those that use flammable fuels. In the hands of a careless person, flammable fuel models can be very dangerous. Also, fuel is difficult to find during long term emergencies.

Candle lanterns are wonderful tools for power outages. They do not require flammable fuel, are weather resistant, can produce a decent amount of light, and most can burn for 8 to 10 hours continuously. Some can even be fitted with citronella candles to keep mosquitoes under control if you are stuck outdoors in the summertime, or with aromatherapy candles to help you get through stressful situations. Candle lanterns do not produce as much light as electric or kerosene



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lamps but they will not fail, will provide useable light and are the most cost effective of all the illumination methods listed.

If you require more light, you will need a system that can generate power.

Power

If you live in an apartment, emergency power generation is tricky. Gas-powered generators cannot be used because of the volatility of the gasoline and the potentially lethal carbon monoxide exhaust fumes. High-tech methods to generate indoor power (such as hydrogen fuel cells and thermophotovoltaic generators) are still being tested by manufacturers and will not be available to consumers for years to come.

The only safe, reliable, and simple method of emergency electrical power generation available to you is solar and in some limited cases wind power. With a few adjustments and adaptations in your home, you can use solar modules and small wind turbines for emergency electrical power generation in practically any living environment that has a decent amount of sunlight or wind. A system of this type will generate just enough electrical energy to charge a 12V deep cycle battery. When combined with a device called a power inverter (this changes DC current into AC), you can use it to run small energy saving lights, a radio, small TV, or even a small portable refrigerator- this is especially important for diabetics, for whom insulin must be refrigerated. Many people around the world are embracing this method of power generation. They are setting up small power generation systems in unlikely places like apartment buildings, small businesses, and other environments.

Emergency solar and wind powered systems vary in their size and output. A basic emergency solar power system consists of the photovoltaic module (solar cell), which converts sunlight into electrical energy; the storage battery to hold this energy; and the inverter.

A basic emergency wind powered battery recharging system would consist of:

- The turbine
- A steel mast to hold the turbine. Water pipes, old fence poles, or scaffold tubing will do.
- Guy wire (galvanized steel wire) to keep the system steady in high winds.
- Mounting brackets.
- Tensioners (small turnbuckle devices used to add tension to wire).
- 12V DC deep cycle battery.
- Voltage regulator.
- Fuses.
- Ammeter (measures electric current in amperes).
- Electrical wire.

Wind-powered battery recharging systems are in some ways less complex than their solar counterparts. If you live in a fairly windy city a small turbine mounted on a rooftop will supply



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just enough current to keep batteries charged. A wind-powered battery can be mounted on your roof or fire escape.

Many companies offer portable emergency solar power systems that are inexpensive and easy to use. Light-collecting modules must be placed where exposure to sunlight is maximized. This could be on your roof or outside your windows.

Diesel and Gas Generators for Emergency Home Power

If you own your own house, you have the option of using a gas or diesel generator. Gas generators are more commonly used for home emergency power systems, because of the availability of gasoline and their low cost, ease of use, and variety.

Although diesel fuel is not as readily available as gasoline, the generators are much more durable, better at handling larger loads, and able to run on alternative fuels such as vegetable oil. Fuel costs for diesel generators are lower than for gasoline ones, and they need less maintenance.

Base your choice of generator on the following criteria:

- **The size of the electrical load in your home.** Base this figure on the power required to operate only essential appliances such as refrigerators, lights, communications devices, water pumps, peripheral items in your heating system (fans), and some power tools. Include computers if you consider Internet access essential.
- **Durability, ease of operation and maintenance, and spare parts availability.** Do not purchase an engine manufactured in China, or any generic brand generator, unless you have direct access to spare parts and technical support.
- **Whether you need prime or standby power.** Prime power is for when you have no other power source available, and standby power is a backup for your local utility company. Most people in the U.S. only need standby power systems, but some in the rural areas, hard core survivalists, and people who live off grid (deliberately detached from utility lines) need prime power systems. Mini battery powered standby power systems can be improvised but only by people who have experience working with batteries, inverters and other electrical equipment.
- **When diesel is a feasible option:** a four cycle industrial liquid cooled diesel engine is best. They are less noisy and need less maintenance, exhaust venting, filters, and mufflers.
- **Your power requirements.** If you do not operate any devices (such as construction-grade power tools) that require more than four (4) horsepower, you will only need a generator that produces single-phase (120/240V) power. Otherwise, you probably need triple-phase (120/208V-277/480V).



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Emergency Cooking For the Home

During power service disruptions, you will need to have an emergency cooking method. This will require an emergency stove that can be used indoors safely. The simplest and least expensive type is a folding camp stove that works with your emergency candles from your Disaster Kit. Using the extra wicks that come with the candles, a folding stove can boil about one quart of water in 10 to 12 minutes. A more advanced option is the multi-fuel backpacking stoves. These can boil over 16 ounces of water in less than three minutes and use practically any type of fuel—alcohol, kerosene, diesel, and even spirits.

Propane emergency stoves are safer to use, as long as you store the compressed fuel cans in a safe and cool place. These stoves can boil a quart of water in five minutes and can be used like a regular stove until your power is restored, as long as you have enough fuel. Use this type of stove only in well ventilated areas. The burning fuel can quickly and silently fill a room with deadly carbon monoxide gas.

Emergency Heat

To prepare for cold weather emergencies when your usual source of heat becomes unavailable, begin by checking your home for cracks and gaps where warm air can escape and cold air enters. Caulk them up and make sure to install weather stoppers under every door. Then get an emergency heat source that does not produce toxic emissions (carbon monoxide), is sturdily constructed, stable, and UL-tested. Your choice should take into account the particulars of your living space.

Kerosene heaters are relatively inexpensive, efficient heating units of two types, vented (external fuel tanks) and un-vented (fuel tanks attached). Homeowners can use the vented type. People living in apartments must use un-vented heaters due to a lack of space and fire safety concerns. But un-vented heaters produce dangerous fumes and therefore require a lot of ventilation. To operate on safely, you would need to keep your windows open, an obviously inefficient setup.

Electric space heaters are less expensive and do not produce fumes, but electricity may not be available during an emergency. If you choose to purchase an electric space heater, make sure that it has an on-off indicator light, an automatic shut-off switch for when the unit is knocked over, and a long cord. Plug it directly into the wall—do not use extension cords or overload the outlet.

Gas heaters are the cleanest-burning fuel-consuming devices. They do not need venting or electricity (unless you purchase a model with a blower). However, most people do not have safe place to store large quantities of propane.



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Worst Case Situation Heating

To endure protracted crises, you will need to consider another method of keeping your home warm. The only sure-fire emergency heating device that does not require specially prepared and volatile fuel is the wood burning stove. During the winter of 2002-2003, tens of thousands of Russians survived by using wood burning stoves. Across the country, old and poorly maintained water pipes and boilers burst, leaving many people without heat and hot water during one of the coldest winters in decades. Old rolled up newspapers, clothing, and other materials were burned for life saving heat in the -30 degree Celsius environment. For many Russians, knowing how to safely heat their homes with this type of stove saved them from hypothermia, frostbite, or death.

Worst Case Situation Emergency Apartment Heating

A trail stove can heat your home, food, and water. A number of companies manufacture numerous brands of these trail stoves.

- Before installing the stove, select an area close to a window for the stove pipe and vent.
- All flammable material must be moved away from the unit.
- Keep a mid-sized ABC fire extinguisher nearby on a wall mount.
- Do not put the stove where it blocks an exit.
- If you have children, erect a barrier around the stove to keep them from the hot surfaces.
- Remove the curtains from the window with the stovepipe air vent. Besides the stove you will need the following:
 - 90 degree elbow joint (to be attached at the top of the stovepipe in order to direct it).
 - Stovepipe extensions and adapter.
 - Heat shields for any surfaces within thirty-six (36) inches of the stove.
 - Carbon monoxide detectors.

Safe operation of an emergency wood stove requires many modifications. If you are not skilled with home repair and power tools, hire a professional to install the trail stove. A poorly installed or unsafely operated wood stove can jeopardize the safety of your family and everyone in your building.