

“HOW TO KEEP FROM FREEZING”

Clothing and Heating

Why Are We Here Today?

Garth Turley
April 2009

Inspired Counsel from Church Leaders:

“Concerning clothing, we should anticipate future needs, such as extra work clothes and clothes that would supply warmth during winter months when there may be shortages or lack of heating fuel Wood, coal, gas, oil, kerosene, and even candles are among those items which could be reserved as fuel for warmth, cooking, and light or power. Some may be used for all of these purposes and certain ones would have to be stored and handled cautiously”. Elder Benson “Prepare Ye” Ensign Jan 1974

“We do not know when the calamities and troubles of the last days will fall upon any of us as individuals or upon bodies of the Saints. The Lord deliberately withholds from us the day and hour of his coming and of the tribulations which shall precede it—all as part of the testing and probationary experiences of mortality. He simply tells us to watch and be ready.” Elder McConkie “Stand Independent above All Other Creatures” May 1979

“I believe it is time, and perhaps with some urgency, to review the counsel we have received in dealing with our personal and family preparedness. We want to be found with oil in our lamps sufficient to endure to the end.” “I believe the time to disregard this counsel is over. With events in the world today, it must be considered with all seriousness.” Elder Perry “If Ye Are Prepared Ye Shall Not Fear” Ensign, Nov 1995

“...there were only four things that a man really needed: food, clothing, shelter, and fuel.” Elder Perry “Let Him Do It with Simplicity” Ensign Nov 2008

“There is a portent of stormy weather ahead to which we had better give heed.” Pres Hinckley “To the Boys and to the Men” Ensign Nov 1998

Everyday Examples:

* Every City Prepares for an Emergency – Recommendation from Logan City

Examples:

Earthquakes – Utah is Overdue for a large Earthquake - 5.5 to 8+ on Richter scale

<http://earthquake.usgs.gov/eqcenter/recenteqsww/> - 17 eqs last week of 3/09 in UT

Ice Storms - 870,000 homes and businesses lost power from Oklahoma to West Virginia – 1/28/09

Wind Storms - Provo City Micro Burst 1995

Katrina Hurricane - 2005

Flooding – Red River 3/28/09

* FERC Commissioner said last summer the power grid was very close to overload

In all probability the electric power grid will fail for a significant length of time within our lives. If we are prepared we will be able to “weather the storm”. There are many aspects to being prepared: Water, Sanitation, Food, Shelter, etc. We will focus on two: Clothing and Heat.

When Utilities Go Down (WUGD)

CLOTHING

An individual can “Weather the Storm” better in cold conditions if they are warm. There are two basic concepts used in clothing to keep warm: Layering and Foam. Most important principle to remember: NO COTTON (it keeps the moisture close to your skin and allows body heat to escape).

Layering – Principles: wear several layers of specific types of clothes (add more, or less layers depending on the conditions, and temperature)

• **Base layer** - You want a tight fit to skin for wicking the moisture away from the skin. For LDS Garments, the Church makes a synthetic thermal garment (don't use any garments with cotton content for this purpose! Use thin, light weight 100% synthetic polyester.). Long johns and tops. Polypropylene is best, but any synthetic material is better than cotton. Look for end of the season sales: Sam's Club, Shopco, J C Penneys. Brand names: CuddlDuds or Chill Chasers. Comes in warm and warmer with inside fleece.

Pros: Inexpensive, about. \$5-16 ea piece; easy to pull clothes over as they are slick on outside, cheap at season-end close outs, two kinds – warm and warmer

Cons: Not as many choices, have to do the leg work to find the good buys and needed sizes; however, more stores are carrying these.

• **2nd Layer** - Insulating – Snug but more loose fitting. Fabric can be Synthetic polypropylene, polyester & open cell foam; natural wool, silk, fleece, etc. These fabrics stay warm even when wet and dry quickly. Just verify (for cold weather) no cotton content. (100% cotton is great in extremely hot and humid weather. It holds moisture and acts as a natural air conditioner.) Add more insulating layers for conditions and temperature.

• **3rd Layer** - Wind/Water Protection – What type is dependant on what temperature you will be subject to. For extreme temperatures (below 28 deg F) Look for synthetic non-sealed (non-waterproof) but tightly woven, wind resistant fabric shell. Remember, you are just trying to keep the wind (heat sucking) off and at these lower temperatures, there is no water (rain, snow melt) to get wet from. For temperatures (above 28 deg F) look for breathable waterproof fabrics (Gore-Tex, etc). Any water proofing will slow down the evaporation process, so only use when you have to and if the outer layer is waterproof and non-breathable, your body moisture will be trapped by the waterproof barrier. Buy water proofing spray cans for when the fabric begins to leak.

US Military Cold Weather Clothing System - Layering

- Available at Smith and Edwards or other Army surplus stores.
- Base layer - Looks like a sweat suit (top and bottom), polypropylene
- 2nd layer (quilted vest or jacket and pants)
- 3rd layer (wind/water breaker jacket or parka and pants)
- Booties (to sleep in)
- Caps (can also sleep in to keep body heat in)
- Balaclava - Full head covers with eye opening – fleece
- Gloves and glove liners

- Boots and socks, sock liners
- **Pros:** Inexpensive and very warm: About \$7-10 each piece, coats are more
- **Cons:** Only come in long, have to hem legs, not attractive

National Brands of Outdoor Cold Weather Layering

- Sold in sporting goods/outdoor stores
- Example: Armour and Cabela's hunting systems; synthetic, wool, silk
- **Pros:** Scientifically designed layers; systems for hot, regular, cold and extreme cold; some are attractive; many choices
- **Cons:** Expensive, about \$30-40 ea piece, cheaper when on sale, many sales clerks cannot give you the needed info to make decisions

Box Store Brands:

- 2nd layer: Synthetic fleece vests and jackets (can get on close-out sales for about \$5 at Old Navy, etc.)

Pros: Inexpensive, esp. on sale, more affordable for families, easy to find

Cons: Takes your time to find sizes and prices, low to intermediate quality and fabrics

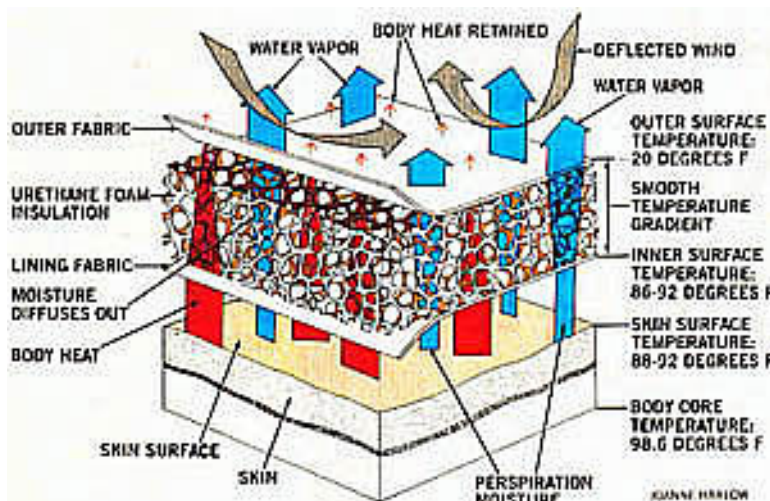
- 3rd layer: Wind resistant, water resistant, synthetic coats and pants. Be careful to not purchase a coated fabric because your body moisture cannot escape

Pros: Can find good buys, great for large families, regular winter coats and outdoor pants can be chosen with this system in mind,

Cons: Lower quality fabrics

Foam Clothing – Principles: Open-cell foam has a nature ability to pull moisture away from the body and allow it to evaporate.

Foam clothing is the brainchild of Jim Phillips. He has a web site where foam clothing can be purchased or you can make you own. The basic technology is as follows:



Highest Performance Cold Weather Clothing on Earth!

Anyone can be truly warm and comfortable at temperatures from above freezing to well below Zero with ease. It's not magic, it's science. The technology and equipment have been in development for over 30 years. We call it "P.A.L.S." (The Phillips Arctic Living System).

Taken from Jim Phillips Web Site: <http://www.jimsway.com>

Jim Phillips Thermal Johns™ (TJ's™)

- People can live in smart clothing without heat, even outdoors
- Good for inside or evacuation, when cannot take lots of fuel with you
- Approx. costs:
- **Pros:** Made to fit, someone else does all the work, best for extreme cold protection, but works in all conditions.
- **Cons:** Expensive

Home-made Foam Clothing

- Purchase the fabric (contact Jim Phillips or Joan Elder, joan_elder @comcast.net)
- Purchase a sheet of open-cell foam. (contact Jim Phillips or Joan Elder)
- Obtain a pattern, cut and sew
- You can also purchase synthetic wind breaker or jogging suits on sale and insert the open cell foam into it. Use the suit for the pattern. Don't use a cotton jogging suit, and fabric must be uncoated – no rubber or plasticized coating
- **Pros:** Less expensive but end product can be excellent
- **Cons:** You have to find materials, time and make the clothing

HEATING - For a House

Water Pipe Freezing

During long term power outage in cold conditions, you must be careful to protect your home from freezing. Most homes will maintain adequate heat for several hours that will keep pipes from freezing (depending on insulation, direct sunlight on the home, outside temperature, etc). However, if the power outage is expected to last several days or a week or more, and you do not have a alternate heat source, or in the case of an evacuation, you must take steps to protect the water piping in the home from freezing. Frozen pipes will often break, and after thawing will cause a lot of damage.

Moving water will not freeze as easily, so the easiest short term solution is to open the faucets to allow a slow drip. However, this solution will only protect the lines the water is flowing in (IE opening a bathroom faucet will not protect the water line going to the toilet or shower).

The most reliable solution is to drain all the pipes. Before proceeding, ensure you have enough water for your future needs. Locate your main water valve into the home, and close. Open the drain valve on the main line, (sometimes no water will drain until a faucet is opened. Locate the highest faucet in the home and open to the cold water side). This will drain the cold water from the lines. Locate your water heater, and open the drain valve. Turn the opened faucet now to the hot side. Don't forget your toilet bowls and tanks, clothes washers, dish washers, water and sump pumps (If electricity runs your water pump, a power outage could restrict your water use. Save as much water as possible in covered containers where it will not freeze.), furnace boilers (if you have one, this is not common), shower and sink traps, etc.

If staying in your home with an alternate heat source is an option, but only part of the home will be heated, you may want to install additional valves and drains to isolate the home or use the drip system solution. Each home is unique, so check your options carefully and make your plan now.

Home Protection/Preparation to Prevent Pipe Freezing

- Seal cracks around doors and windows with sealing tape, towels and blankets. Limit Area to be heated
- Select a space on the "warm" side of the house, away from prevailing cold winds. It's best to avoid rooms with large windows or un-insulated walls. Interior rooms, such as inside bathrooms or closets, probably have the lowest heat loss.
- Your basement may be another great option in cold weather, because of the heat gain from the earth.
- Isolate the room from the rest of the house by keeping doors closed. Hanging bedding, heavy drapes, blankets or towels over entryways, windows, hallways, etc. or erecting temporary partitions of cardboard or plywood.
- If your windows are broken in an earthquake, put heavy visquine plastic, cardboard, or plywood sheets over window frame to seal out cold. Use heavy duty duct tape. Put a layer of clear plastic on the inside and one on the outside of the window frame to make a dead air space between the two layers. Plastic will allow light to come in during the day.
- Do the same with other damaged walls in the house.

Secondary Heat Sources

Cost Comparisons of Fuel Types

The Energy Information Administration's Heating Fuel Comparison Calculator - estimates the costs to produce 1 million Btu:

\$14.39 Wood Pellets

\$15.83 Wood Solid.

\$5.35 Coal

\$19.62 Natural Gas

\$22.59 Heating Oil

\$27.77 Propane

\$30.82 Electric furnaces, baseboards, and space heaters.

Generators – 1st Choice



A standby electric generator is a good investment. It can assure electricity to run the natural gas/liquid propane furnace's fan and controls. There are several types, sizes and safety rules to follow. Please refer to the class on generators for more information.

- Never run generators indoors or even in the garage; they produce large amounts of toxic carbon monoxide

- **Pros:** Small space required, allows running multiple household appliances (depending on unit's size and loads), easy to use and maintain, very reliable.
- **Cons:** Requires fuel storage depending on type of generator (gas, propane, diesel), produces carbon monoxide, noisy although muffler can help, can be expensive depending on size/type

Natural Gas/Propane VENTED – 2nd Choice



- Gas stove (free standing, vented)
- Gas fireplaces with glass doors
- Gas fireplace insert

- These vented units are excellent and can be used for long-term space heating all winter
- Get a stove than can be later fitted to burn propane in case natural gas goes down (during a long term electric outage, natural gas pumps will be unable to keep the pressure high enough to use)
- Fuel: Natural gas, Liquid Propane (LP) tanks (tanks should be outside house)

• **Pros:** Lights easily, relatively inexpensive fuel, fair performance in colder temps, propane works well down to 0°F, readily available, does not harm soil or water, puts out good heat, can cook on some stoves, stores indefinitely.

• **Cons:** Ignition sources can cause explosions (i.e., water heaters & electrical sources), may need permit to store large quantities, propane is heavier than air & can collect in low places (i.e. basements, pits, floors) and can ignite/explode, steel propane cylinders are heavy, large cylinders are difficult to move. 500 gals last approx 1-2 months depending on temp, use, etc.

Wood, VENTED – 2nd Choice



- Wood stove (free standing, vented) – gives great heat
- Wood fireplace insert – some brands radiate good heat
- Wood fireplace with glass doors – good only for temporary heat
- Wood fireplace with no doors – very poor heat, don't count on it
- Wood furnace in outdoor building – great heat and safer for your house as the combustion is outside
- Wood Pellet Stoves – very efficient but requires electricity

- Most Stoves can be converted to burn coal as well. Coal burns hotter, longer per lb.
- Can heat bricks and rocks on some wood stoves; bricks hold heat for some time and radiate it back out, cover with towels and take into other rooms
- Can cook on some wood burning stoves
- Some Good brands (according to Consumer Reports):
 - Fireview Soapstone Wood Stove (\$2500)
 - Lopi Liberty Wood Stove (\$1800)
 - Napoleon Small Pedestal Wood Stove Package (\$1200-\$1700)
 - Jotul F 118 CB Black Bear (\$1500)

For more information on manufacturer ratings see: <http://hearth.com/ratings/search.php>

For more information on wood stoves see: <http://www.woodheat.org/technology/woodstoves.htm>

- **Pros:** Fuel is readily available in some areas, you can chop & haul your own, smells nice while burning, no toxic fumes, can be burned indoors and outdoors
- **Cons:** Stoves can be more expensive, wood is scarce in some areas, wood burning in non-EPA approved stoves is banned on “no burn days,” wood fuel requires ample storage space, should be protected from moisture, requires a year’s seasoning before use, “Know Your Wood” or you will be stuck with poor burning species.
- **Seasoned dry wood:** Fire wood must have between 15 - 20% moisture to burn properly. To get that the wood must be cut and allowed to dry for at least a full summer. Wood must be properly stacked, off the ground to dry.
- **Types of wood:** What is the best tree species for firewood? While there is always room for debate, I would like to suggest that the best species in your area is the one that is most plentiful, easy to split and doesn't cover your hands and clothes with sticky sap. All wood, regardless of species, has about the same energy content per pound. The different species vary only in density. Traditionally, the favored trees in central North America were oak and maple because they are very dense and produce long-lasting coals. But these are valuable trees and in many areas are not plentiful enough to burn. No problem, just use softer woods like birch or poplar (aspen) or any other tree that is readily available. Keep in mind that people living in the coldest areas of North America have no hardwoods to burn and they get along just fine. Ultimately, it is more important to have wood that is cut and split to the right size and properly dried than it is to get the hardest wood available.
- **Stacking Wood:** Lay a base for the stack. This can be two two-by-four or two-by-six boards or two long poles or branches. Lay them far enough apart to lay an average piece of firewood. Set the base facing east-west so your stack will have more sunlight during the winter. Pick out some pieces shaped like half-moons and quarter-moons. At each end of the pile, place a half-moon piece with the flat side up across the base. Place two quarter-moon pieces at right angles across the half-moon shape, with the angles sides facing down. You now have a solid base for your stack. Stack the firewood across your base, mixing sizes and types of wood as much as possible to provide optimum airflow. Continue stacking until the stack reaches the desired height (best below 4ft). It will also be easier to measure a cord of wood, which is 4 feet high by 4 feet wide by 8 feet wide. Cover the stack with a plastic tarp, or build a shelter over the top to keep the wood dry.

Tips & Warnings - Never pile firewood directly on the ground and never stack firewood near your house. Both are invitations for hungry termites that can find their way into your house.

No City restriction on wood storage, just store away from home or garage.

- Rolled newspapers

- Fire Starters

Are good sources for getting your fire started.

Natural Gas/LP UNVENTED – Low CO Emission - 3rd Choice

(NOTE: All un-vented open-flame or closed flame still burn oxygen, and proper air flow must be allowed for. Consult manufacturer recommendations.)



- Unvented or Vent Free - natural gas or LP units like this one can be used indoors as they are clean burning. 99% heating efficient
- Vent free units are thermostatically controlled to automatically modulates the heat output and flame height from 16,000 to 30,000 and pilot, in order to maintain a consistent room temperature.
- Porcelain reflective back creates a third set of "flames" thru screen front.
- Heats up to 1,000 square feet
- Push button ignition for easy pilot lighting.
- Heater has a pilot with an Oxygen Depletion Sensor Shutoff System (ODS), which shuts off the heater if there is not enough fresh air.
- Requires no electricity to operate the stove.



Kozy World WM-KWN321
(LP OR NG)

- Features:
- Ceramic Infrared Burner - Heats like the Sun! 30,000 BTU for the NG (Natural Gas) or 25,000 BTU for the LP (Liquid Propane)
- Fuel: LP Gas or NG Gas
- 99.9% Fuel Efficient
- Top Mounted Controls
- No Electricity Required
- Safe Watch (tm) Pilot / ODS System
- Operates without electricity, providing heat during power outages.
- Safe, odorless and clean burning
- Variable Heat Control
- Large Heat Output
- Dimensions: 23.5(H) x 26.63(W) x 8.0(D)
- Heating area - approximately 1,000 square feet
- 5 (five) plaques



Comfort Glow RF30T

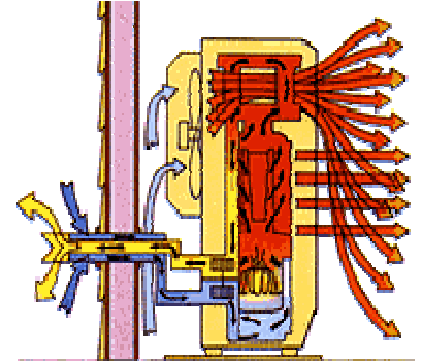
- **Pros:** Lights easily, relatively inexpensive fuel, fair performance in colder temps, propane works well down to 0°F, readily available, does not harm soil or water, puts out good heat
- **Cons:** Stoves can be more expensive. Ignition sources can cause explosions (i.e., water heaters & electrical sources), may need permit to store large quantities, Propane is heavier than air & can collect in low places (i.e. basements, pits, floors) and can ignite, steel propane cylinders are heavy. A vented heater is preferred and recommended.

- Natural gas or LP units emit carbon monoxide and water which can raise the indoor pollution levels too high. Proper ventilation must be provided.

Natural Gas, LP or Kerosene – VENTED – 4th Choice



- Stoves/heaters for the house can be used as emergency or as a space heater all winter
- Great heat for a room or two, 8- 40,000 BTUs for up to 2000 sq ft
- Gives off carbon monoxide which is vented out of the home
- External fuel tanks (outside) for LP & Kerosene. Can hold several weeks' fuel supply and can be filled outside



Toyo Vented Kerosene Heater

Brands: Toyo (Kerosene), Rinnai (Natural Gas or LP)

Kerosene

0.301 gal/hr - 40,000 BTU/Hr (high)

0.203 gal/hr - 27,000 BTU/Hr (medium)

0.113 gal/hr - 15,000 BTU/Hr (low)

- **Pros:** Inexpensive to purchase and maintain. Very efficient (85-87%),
- **Cons:** Must store fuel, Kerosene has a strong odor, Kerosene is expensive (\$5.89/gal locally at Jardines)

-Cheaper and more easily stored

- Four 55 gal drums will last one winter

-Store off concrete

-Diesel fuel additive extends storage life 2-5 years (like Sta-bil)

• Natural Gas/LP UNVENTED (Portable) – Low to High CO Emission – 5th Choice

(NOTE: All un-vented open-flame or closed flame still burn oxygen, and proper air flow must be allowed for. Consult manufacturer recommendations.)



- Propane Heaters Portable - Convection ``Reddy Heater - Hot Spot``
15/20/25,000 Btu
- Convection heat creates a clean-burning, odor-free warmth on a 20-lb. propane cylinder. 3-heat settings.
- Heats up to 600 sq.ft. Pilotless burner
- System needs no electricity. Piezo matchless ignition
- Good for workshops, job sites, drywalling, patios and recreational activities.



- Reddy Heater 30,000 BTU LP Heater,
- Heats Up To 5,600 CUFT
- Runs Up To 14 Hours On A 20 LB LP Cylinder



- Electricity Required for Motor, Quiet Operation
- Output 1800 – 9000 btu depending on the size purchased
- LP Fuel Consumption – 1/8 lb – 1/3 lb per hr depending on size & setting
- Heated Area – 110 – 290 sqft
- \$300 - \$425

Portable LP Heaters from Northstar Flameless



- 4,000 BTU - low, 18,000 BTU- high
- LP Fuel Consumption - 400 sqft, 20lb tank on low 220hrs
- Automatic low oxygen stuff-off system ODS
- Tip-over safety switch
- Connects 1 or 2 disposable propane cylinders or to a 20 lb
- Battery operated fan included w/ electrical plug option
- CSA certified
- \$75 - \$120

Mr Heater “Buddy” & “Big Buddy”



- 8,500 - 30,000 BTU-
- No electricity required
- Modulating hydraulic thermostat
- \$250 - \$350

“Blue Flame” Type NG or LP



Original Series Tank-top Heaters

- Efficient – Heats radiantly, directly. No loss of heat to air
- LP Fuel Consumption - varying
- No Electricity required
- Convenient – Fully assembled, ready for use.
- Connects to 20lb Cylinder or smaller ones to 2lb
- Quiet – No noisy, annoying blowers
- **Not Indoor Rated**

Mr Heater(s)

- Natural gas or LP units can be used for short emergencies or temporary heating. However, they emit monoxide and water which can raise the indoor pollution levels too high.
 - Only use in well-ventilated rooms with a window cracked open.
 - They use oxygen; only use units with a low-oxygen level shut-off.
 - Remember that propane can collect in low places, ignite and explode.
- **Pros:** Lights easily, relatively inexpensive fuel, fair performance in colder temps, propane works well down to 0°F, readily available, does not harm soil or water, puts out good heat
 - **Cons:** Ignition sources can cause explosions (i.e., water heaters & electrical sources), may need permit to store large quantities, Propane is heavier than air & can collect in low places (i.e. basements, pits, floors) and can ignite, steel propane cylinders are heavy. A vented heater is preferred and recommended.

Kerosene – UNVENTED – 6th Choice



- Unvented kerosene heaters, with attached fuel tanks, can be used for emergency or temporary heating. However, all the combustion products, including carbon monoxide and water, enter the living area. To be sure that these products do not raise pollution levels to unacceptable levels, use unvented kerosene heaters only in well-ventilated rooms.
- Also, all units must have a low-oxygen level shutoff. Follow the manufacturer’s instructions.
- The heater must be used with the proper fuel and should only be fueled outside the house after the heater has cooled.
- Because windows must be opened when unvented kerosene heaters are used, these heaters can be expensive to operate.

21ST CENTURY Model OR77/78

For guidelines on choosing a portable Kerosene Heater and operations of see:

<http://www.cojoweb.com/emerg-roomheating.html>

• Logan City codes allows the use of “UL” listed portable heaters, but with a maximum 2 gals capacity in non-occupied living spaces.

- **Pros:** Relatively inexpensive for heater, abt. \$120, can cook on top of them
- **Cons:** Kerosene has a strong odor and is fairly expensive (\$5.89/gal locally at Jardines), Refill only outdoors. A vented heater is preferred and recommended. Must store fuel.

Fuels – Types, Storage and Safety

NOTE: Logan City codes prohibit the storage of flammable liquids in homes, basements, and/or garages. Remember to put a fuel additive to any stored fuel. Pri-G for gasoline, and Pri-D for diesel or kerosene, or Sea-Foam.

Coal

- Burn outdoors only or in approved vented fire box.
- Fuel: Coal produced carbon monoxide - deadly fumes
- Can heat bricks and rocks which hold and radiate heat for some time
- Coal is the least expensive fuel per BTU that the average family can store.

- No City restrictions on storage amount, just store away from home.



With the proper protection your wood stove can burn coal. It should be brick lined, with a metal grate that keeps the coal off the floor for proper burning. Start fire using wood, then add coal. 4-5 tons needed for the whole year.

- **Pros:** Stores well in a dark, dry place, can store in metal 55 gal drums, relatively cheap. No limit on storage size
- **Cons:** Hard to find, dirty and sooty, store away from circulating air, light & moisture, emits toxic fumes; use outdoors

Charcoal

- Burn outdoors only
- Charcoal Grills
- Using a Volcano Stove or Pyromid Stove (abt \$120) improves efficiency of the coal heat. (IE use less coal)
- Fuel: Charcoal Briquettes or homemade charcoal, produced carbon monoxide - deadly fumes
- Can heat bricks and rocks which hold and radiate heat for some time
- No City restrictions on storage amount, just store away from home.
- Charcoal is the least expensive fuel per BTU that the average family can store. Remember that it must always be used out of doors because of the vast amounts of poisonous carbon monoxide it produces. Charcoal will store for extended period of time if it is stored in air tight containers. It readily absorbs moisture from the surrounding air so do not store it in the paper bags it comes in for more than a few months or it may be difficult to light. Transfer it to airtight metal or plastic containers and it will keep almost forever.
- Fifty or sixty dollars worth of charcoal will provide all the cooking fuel a family will need for an entire year if used sparingly. The best time to buy briquettes inexpensively is at the end of the summer. Broken or torn bags of briquettes are usually sold at a big discount. You will also want to store a small amount of charcoal lighter fluid (or kerosene). Newspapers will also provide an excellent ignition source for charcoal when used in a funnel type of lighting device.
- To light charcoal using newspapers, use two or three sheets, crumpled up, and a #10 tin can. Cut both ends out of the can. Punch holes every two inches around the lower edge of the can with a punch-type can opener (for opening juice cans). Set the can down so the punches holes are on the bottom. Place the crumpled newspaper in the bottom of the can and place the charcoal briquettes on top of the newspaper. Lift the can slightly and light the newspaper. Prop a small rock under the bottom edge of the can to create a good draft. The briquettes will be ready to use in about 20-30 minutes. When the coals are ready remove the chimney and place them in your cooker. Never place burning charcoal directly on concrete or cement because the heat will crack it. A wheelbarrow or old metal garbage can lid makes an excellent container for this type of fire.
- One of the nice things about charcoal is that you can regulate the heat you will receive from them. Each briquette will produce about 40 degrees of heat. If you are baking bread, for example, and need 400 degrees of heat for your oven, simply use ten briquettes.
- To conserve heat and thereby get the maximum heat value from your charcoal you must learn to funnel the heat where you want it rather than letting it dissipate into the air around you. One excellent way to do this is to cook inside a cardboard oven. Take a cardboard box, about the size of an orange crate, and cover it with aluminum foil inside and out. Be sure that the shiny side is visible so that maximum reflectivity is achieved. Turn the box on its side so that the opening is no longer on the top but is on the side. Place some small bricks or other noncombustible material inside upon

which you can rest a cookie sheet about two or three inches above the bottom of the box. Place ten burning charcoal briquettes between the bricks (if you need 400 degrees), place the support for your cooking vessels, and then place your bread pans or whatever else you are using on top of the cookie sheet. Prop a foil-covered cardboard lid over the open side, leaving a large crack for air to get in (charcoal needs a lot of air to burn) and bake your bread, cake, cookies, etc. just like you would in your regular oven. Your results will amaze you. (See handout Box Oven for a more longterm homemade charcoal oven.)

- To make your own charcoal, select twigs, limbs, and branches of fruit, nut and other hardwood trees; black walnuts and peach or apricot pits may also be used. Cut wood into desired size, place in a large can which has a few holes punched in it, put a lid on the can and place the can in a hot fire. When the flames from the holes in the can turn yellow-red, remove the can from the fire and allow it to cool. Store the briquettes in a moisture-proof container. Burn charcoal only in a wellventilated area.

- **Pros:** Fuel can be homemade, easy to locate, cheap, indefinite shelf life, non-volatile, Heat is predictable. Each briquette produces about 25°F of heat, so 14 briquettes x 25 = 350°F. 25#s = 2 meals/day for 2 weeks for 14 people. 200-400 lbs = 1 year for family of 6+

- **Cons:** Only outside, produces deadly carbon monoxide, absorbs moisture readily so store in airtight container like metal garbage can with tight fitting lid, requires lighter fluid to ignite or funnel can.

Propane

- Burn outdoors, indoors only with window slightly open unless vented

- Propane stove (free standing, vented)

- Use with small Heaters, Stoves, and Lanterns

- Unvented propane heaters/stoves can be used for short emergencies or temporary heating.

However, they emit carbon monoxide and water which can raise the indoor pollution levels too high.

Only use in well-ventilated tent with a window cracked open.

- They use oxygen; only use units with a low-oxygen level shut-off.

- City restricts storage to 25 gals or 100 lbs, stored outside & away from home or garage.

- **Pros:** Lights easily, relatively inexpensive fuel, fair performance in colder temps, propane works well down to 0°F, readily available, does not harm soil or water, puts out good heat, can cook on some stoves, stores indefinitely

- **Cons:** Ignition sources can cause explosions (i.e., water heaters & electrical sources), may need permit to store large quantities, propane is heavier than air & can collect in low places (i.e. basements, pits, floors) and can ignite/explode, steel propane cylinders are heavy, large cylinders are difficult to move. Need a large about for long term heating (1000lb + for a winter)

Butane

- Burn indoors or outdoors

- Use with small Heaters, Stoves and Lanterns

- Stoves: Porta-Chef stove about \$10-20

- City restrictions storage to 100 gals total w/ other fuels, stored outside & away from home or garage.

- **Pros:** Can use indoors (emits CO and NO₂) or out, convenient, clean burning, easy lighting, no pumping or priming, burns hot immediately, adjusts to simmer easily, easy refill – snap on new canister, works well at high altitudes, some stoves are very small and portable

- **Cons:** More expensive fuel, performance decreases in temps below 32° F, blended butane/propane and isobutene fuels work better in cold temps. Emits NO₂

White Gas

- Burn outdoors only
 - Gas Grills and stoves
 - Do not use in a tent. Carbon Monoxide is known as a “silent killer.” It is an invisible, odorless, tasteless gas and is highly poisonous.
 - Can heat bricks and rocks on the grill to take into the tent; wrap them up in a towel; they hold heat for some time
 - Use with Stoves and Lanterns
 - Fuel: White gas is not gasoline or kerosene. White Gas - Coleman Fuel, Shellite, Mobilite, Pegasol, etc.
 - When used with a Coleman stove, this is another excellent and convenient fuel for cooking. It is not as portable nor as lightweight as Sterno, but produces a much greater BTU value. Like Sterno, Coleman fuel has a tendency to evaporate even when the container is tightly sealed so it is not a good fuel for long-term storage. Unlike Sterno, however, it is highly volatile; it will explode under the right conditions and should therefore never be stored in the home or tent. Because of its highly flammable nature great care should always be exercised when lighting stoves and lanterns that use Coleman fuel. Many serious burns have been caused by carelessness with this product. Always store Coleman fuel in the garage or shed, out of doors.
 - City restricts storage to 25 gals (in combination with gasoline, IE 25 total gals of white gas and gasoline), stored outside & away from home or garage.
-
- **Pros:** Easy to find, clean burning, easy to light, spilled fuel evaporates quickly, produces a lot of heat
 - **Cons:** Expensive, volatile, spilled fuel can ignite quickly, priming required, produces carbon monoxide, store fuel outside, can evaporate like Sterno, highly flammable so use care

Diesel

- Burn outdoors only
 - City restricts storage to 60 gals (in combination with Kerosene and oil lamp, 60 gals total), stored outside & away from home or garage.
-
- **Pros:** Easy to find, inexpensive, low volatility, burns well in some stoves, treated diesel can be stored up to 10 years without degrading,
 - **Cons:** Emits toxic fumes, clogs some stoves, gels in cold weather, protect from microbial growth and water condensing in fuel.

Diethylene Glycol & Isoparaffin

- Can burn indoors and outdoors
 - Fuel: Eco-Fuel, Heat it, Camp Heat, Dual Heat, Magic Heat
 - Burn time: 8 hrs at 200° F, 4 hrs at 450° F
 - Unlimited shelf life, never evaporates, even left open, non-flammable outside its container, no toxic fumes, clear odorless liquid, even flame
 - City restricts storage to 55 gals total with other fuels, stored outside & away from home or garage.
-
- **Pros:** Works great for small cooking or heating needs. Safe, No flash backs when lighting, burns constituent temperature, smokeless.
 - **Cons:** 24 cans cost about \$70, 24 cans = 192 hrs at moderate cooking temp or 96 hrs at high temp, harder to find.

Kerosene

- Burn outdoors or indoors with window opened
 - Un-vented kerosene heaters, with attached fuel tanks, can be used for emergency or temporary heating. However, all the combustion products, including carbon monoxide and water, enter the living area. To be sure that these products do not raise pollution levels to unacceptable levels, use un-vented kerosene heaters only in well-ventilated rooms with a window cracked open.
 - Also, all units must have a low-oxygen level shutoff. Follow the manufacturer's instructions.
 - The heater must be used with the proper fuel and should only be fueled outside after the heater has cooled.
 - Stoves: Alpaca type kerosene cook stove – 8,500 BTUs, holds .9 gallons, lasts 16 hrs, abt \$90, replacement wicks abt \$8. Kerosene cook stoves with 1, 2, & 3 burners, abt. \$100
 - Fuel brands: Liquid range oil, No. 1 Paraffin, Kero, Jet-A
 - City restricts storage to 60 gals (in combination with diesel and oil lamp, 60 gals total), stored outside & away from home or garage.
- **Pros:** Kerosene fuel is one of the safest and most economical fuels. But use more because window has to be cracked open, stoves abt. \$120, can cook on top of them, fuel easy to find worldwide, burns easily, high heat output, low volatility, can be used indoors,
- **Cons:** A vented heater is preferred and recommended, burns dirty, has order when igniting, priming required, can gum up stove parts, uses oxygen in a room - crack a window

Manure

- Burn indoors or outdoors
- Cow or buffalo chips
- **Pros:** Inexpensive if you are on a farm, burns well
- **Cons:** Needs to dry before using, need large on-going quantity and easy to reach storage, possible unpleasant odor

Alternative Power Sources

Solar Power

Solar panels are becoming more cost effective every year and many States and Cities have rebates for solar system installations (along with a Federal Tax rebate). However, here in the northwest, even with these incentives the payback period is still many years out. Most solar systems are installed for the security and “peace of mind” for the contribution towards a greener planet than for the cost benefits. Solar power is generated in DC volts and must be “inverted” to AC voltage for household use. This is accomplished by an inverter. Backup batteries can be installed with a solar system for use after daylight hours. Solar installations require a building permit before construction.

- **Pros:** Good long-term choice, good in sunny locations, no odor, no mess, quiet, life span of 20 years
- **Cons:** Very expensive to set up (abt \$15,000+ per home), full power from the sun occurs only during a few hours in the day, batteries last only a few years, not suitable for apartments.

Wind Turbines

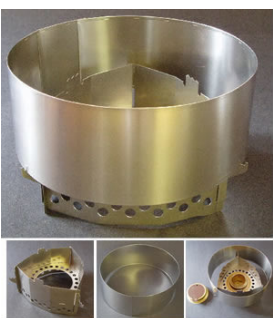
Wind turbines are also becoming more cost effective every year. However, there are fewer rebate options with small wind projects. Consult with your local City and State representatives for details. Wind turbines generate power in DC volts and must be “inverted” to AC voltage for household use. This is accomplished by an inverter. Wind turbine installations require a building permit before construction.

- **Pros:** Good long-term choice in windy locations, no odor, no mess, quiet
- **Cons:** Expensive to set up (abt \$10K for a large unit, \$3000 for a small unit), needs wind, requires way to store and convert power (IE battery backup system), not suitable in city or for apartments.

Power Inverters/Battery

- Inverter are devices that convert DC (IE think batteries) voltage to AC voltage for use on typical appliances. A power inverter can be a lifesaver if you need to heat up formula for your baby or power up an incubator for chicks, or just to have electricity during an electric outage. It enables you to use a common electrical device or appliance in your car or any place that has access to a 12 volt battery. Power inverters can be purchased in a computer store, camping/recreation vehicle stores, in marine supply stores, Walmart, Samsclub, Costco or online. They cost from \$25, for a simple 100 watt unit, up to several hundred dollars for large units that will enable you to use electric appliances and provide power for up to 24 hours (depending on your battery size or if the car is running).
 - The 100-watt unit allows you to heat several normal-sized heating pads. Average heating pads use 25 watts. Wrap these heating pads up in towels and place them in a bed, the bottom of a pet carrier or incubator, etc.
 - Accessories: To use this item in your home, you can buy an accessory for the power inverter - a detachable set of miniature jumper cables that cost about \$5 to \$10. This cable allows you to bypass plugging the power inverter into your car's cigarette lighter and enables you to hook up directly to any 12 volt battery. An extra, fully charged car battery is inexpensive and will work for 6 to 12 hours, depending on what you plug into the inverter and how much electricity that device uses. You can purchase small rechargeable electric batteries that will last for 6 hours each. They are compact, about one third the size of a car battery, and really add to the portability of your power inverter. They last for years and are well worth the extra cost. Expect to pay between \$80 to \$100 dollars for one of them.
 - Multiple Batteries: If you anticipate lengthy outages, multiple batteries are recommended to extend the length of time that you can provide power.
 - Larger Units: If you have larger power requirements, a 400 watt power inverter would be advisable. They cost hundreds of dollars less than a gasoline generator but handle the same electrical capacity.
 - Suggestions: Powerpack by Xantrex – 600 watt AC inverter (internal) surge/ 400 Watt sustained, with 28 amp/hr battery, 3 AC sockets 1 DC socket, recharged by AC or DC so can recharge from a solar panel, jumper cables, AM/FM clock radio, alarm clock, built-in light; MSRP \$229, Amazon \$140, use super saver shipping
 - Remember you get what you pay for, don't buy a cheap one.
- **Pros:** Inexpensive backup power for the short term, varying sizes, low cost
 - **Cons:** limited to your power source, stand alone battery will last a few hours depending on the use.

HEATING/COOKING – For Outside (some units can be used in a Tent)



Alcohol Stoves

- Burn indoors or out
- Suggested: Trangia based stoves (screw on cap allows you to save unburned fuel) - Clikstand, Westwind (cheaper)

- Fuel: Denatured alcohol – Methylated, Spirits, Metho, Ethynol, Alcohol Stove Fuel
 - **Pros:** Can burn indoors or out; zero percent failure rate, low volatility, burns almost silently
 - **Cons:** Open flame, cooking takes longer, requires more fuel, lower heat output
- Trangia ClickStand Trangia Westwind Stove

Canned Heat (alcohol gel) Stoves



Diethylene Glycol Fueled Stove

- Burn indoors or out
- Sterno Fuel, a jellied petroleum product, is an excellent source of fuel for inclusion in your back pack as part of your 72 hour kit. Sterno is very light weight and easily ignited with a match or a spark from flint and steel but is not explosive. It is also safe for use indoors.
- **Pros:** A Sterno Stove can be purchased at any sporting goods store and will retail between \$3 and \$8, depending upon the model you choose. They fold up into a very small, compact unit ideal for carrying in a pack. The fuel is readily available at all sporting goods stores and many drug stores. One can of Sterno fuel, about the diameter of a can of tuna fish and twice as high, will allow you to cook six meals if used frugally. Chafing dishes and fondue pots can also be used with Sterno.

- **Cons:** Open flame. Sterno is not without some problems. It will evaporate very easily, even when the lid is securely fastened. If you use Sterno in your 72 hour kit, you should check it every six to eight months to insure that it has not evaporated beyond the point of usage. Because of this problem it is not a good fuel for long-term storage. It is a very expensive fuel to use compared to others fuel available, but is extremely convenient and portable.

Wood Tent Stoves, VENTED

- Burn indoors or outdoors
- Choose stove carefully, some are bad; consider the wood pellet-burning small stove that doesn't require an electric auger, just throw several pellet bags into your truck and you don't have to chop wood in cold weather or middle of the night
- **Pros:** Well designed stoves produce good heat, fuel is readily available in some areas, you can chop & haul your own, smells nice while burning, no toxic fumes, can be burned indoors and outdoors
- **Cons:** Stoves range from cheap to expensive, some stoves can be tricky to operate – practice beforehand so you won't burn your tent down, wood is scarce in some areas, wood burning in non-EPA approved stoves is banned on “no burn days,” wood fuel requires ample storage space, should be protected from moisture, requires a year's seasoning before use, “Know Your Wood” or you will be stuck with poor burning species.

Wood Fires

- Burn outdoors
- **Pros:** Fuel is readily available in some areas, you can chop & haul your own, smells nice while burning, no toxic fumes, can cook over open fire with proper equipment
- **Cons:** Open flame, some Teepees can use open fires, poor heat in cold weather, requires chopping and hauling, wood is scarce in some areas, wood fuel requires ample storage space, wood should be protected from moisture, requires a year's seasoning before burns really well, “Know Your Wood” or you will be stuck with poor burning species, cannot burn open flames in dry/drought conditions, must be tended, have to wait for coals to cook

Appendix

Sources:

Dare to Prepare, Holly Drennan Deyo, 2nd Edition, Deyo Enterprises LLC, standeyo.com, pp. 284-289.

Disaster Recovery: Options for emergency home heating, Oct., 1993, University Extension, Iowa State University

Clikstand S-1, Art Simon, 2006 update, www.art.simon.tripod.com/Stoves/

What is carbon monoxide?

Carbon monoxide is a colorless, odorless and poisonous gas that can build up in your blood cells as you breathe. It may reach toxic levels in minutes or over several hours. Early symptoms of poisoning include dizziness, headache and/or nausea.

People who are sleeping are likely to be more susceptible to carbon monoxide poisoning since they will not recognize the symptoms. Just getting out in the open air doesn't eliminate carbon monoxide from your body. It takes 10 to 24 hours, so suffocation may even occur after you have left areas with high levels of carbon monoxide.

Do You Like Living In the Dark?

Garth Turley, 09Apr23

Why should we worry about this? Could there be a problem?

Here is the counsel from our modern Prophet: *“For forty years and more members of the Church have been counseled by their leaders to prepare for uncertainty and calamity. Many have followed that counsel; some have turned a deaf ear to it.” “...members of the Church have been instructed to personally store a year’s supply of food, clothing, and, where possible, fuel.”* Pres Benson, *Ensign*, May 1977

Concerning clothing, we should anticipate future needs, such as extra work clothes and clothes that would supply warmth during winter months when there may be shortages or lack of heating fuel. Wood, coal, gas, oil, kerosene, and even candles are among those items which could be reserved as fuel for warmth, cooking, and light or power. Some may be used for all of these purposes and certain ones would have to be stored and handled cautiously. Elder Benson, *“Prepare Ye,” Ensign*, Jan 1974

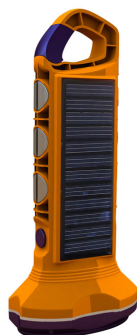
When will we learn these basic economic principles? However, “... when we really get into hard times,” said President Clark, “where food is scarce or there is none at all, and so with clothing and shelter, money may be no good for there may be nothing to buy, and you cannot eat money, you cannot get enough of it together to burn to keep warm, and you cannot wear it.” (Church News, November 21, 1953, p. 4.) Elder Benson, *“Prepare Ye,” Ensign*, Jan 1974

And President Brigham Young said, “If you are without bread, how much wisdom can you boast, and of what real utility are your talents, if you cannot procure for yourselves and save against a day of scarcity those substances designed to sustain your natural lives? ... If you cannot provide for your natural lives, how can you expect to have wisdom to obtain eternal lives?” (JD, vol 8, p. 68.) Elder Benson, *“Prepare Ye,” Ensign*, Jan 1974

Every City Prepares for an Emergency – Recommendation from Logan City
Earthquake, Ice Storms; Provo Micro Burst
FERC Commissioner said last summer the power grid was very close to overload
Wall Street Journal, Apr. 8, 2009, “Electricity Grid in US Penetrated by Cyber Spies”

HOW TO KEEP FROM LIVING IN THE DARK

Lighting



Solar BoGo Light

<http://www.bogolight.com/SearchResults.asp?Cat=55>

\$25 plus s/h

Solar Hybrid Flashlight \$20.00 + s/h

<https://www.chooserenewables.com/xcart/product.php?productid=16176&cat=260&page=1>



The **Hybrid Solar Light** generates the greatest amount of light (using super-bright LIFETIME L.E.D.) with the least amount of effort and environmental impact. It's convenient to use at anytime and **pays for itself by not having to replace expensive batteries or bulbs.**

Key Features Include:

- Provides up to 16 hours of continuous light on a full charge
- Hybrid solar technology generates renewable power from sunlight or room light and stores it for later use
- Holds charge for years without recharging
- Can be recharged over and over
- Rated at over 100,000 hours of use
- Includes emergency battery backup
- 1st Click = Solar Power, 2nd Click = Battery Power
- Waterproof and it floats

How Does the Hybrid Solar Light Work?

The intelligent flashlight uses sunlight, daylight and general lighting to recharge its capacitor when exposed to light. Once charged, the Hybrid Solar Light will work at any time - including at night or otherwise in the dark! The unit also maintains a back-up battery which will only be used if the solar capacitor has run out of charge. This back-up battery is a secondary safety mechanism to make sure you have light when it's needed.

Gordon 8 LED Solar Flashlight

<http://www.harborfreight.com> (has been discontinued)

Ultra bright light output that projects beam up to 40 meters and can last up to 80,000 hours.

- Mono crystal solar panel will last up to 20 years
- Rugged aluminum alloy housing
- Water resistant
- Fully charged batteries will provide up to 8 hours of usable light

Overall dimensions: 7-5/8"L x 1-5/8"W; (1)NiMh Battery cell (included)



\$17 + s/h

Note: Tried this one and I was very impressed with the light output and cost.

SL9000 Solar Lantern \$75 + s/h <http://www.21st-century-goods.com/>



- 9W "Energy Saving" Fluorescent U-Tube lite
 - Features a Low/High power setting
 - Blinking signal light
 - Automatic emergency lighting during power failure
 - Carry Handle
 - Durable plastic construction
 - 2.5W/8.75V solar panel
 - AC house adaptor
 - DC 12V car plug
 - Rechargeable 6V/4AH sealed lead acid battery
 - Over-charge/over-discharge protection
 - 8 hours of charging in bright sunlight supplies 3 hours of power on **high** and longer on **low**
- 30 hours for a full charge in bright sunlight
 - 18-20 hours using the AC adaptor or 12V car plug for a full charge

Note: Great lantern, provides enough light to read by.

Gordon ALL-PURPOSE SOLAR LANTERN

<http://www.harborfreight.com/cpi/ctaf/displayitem.taf?Itemnumber=94740> Item 94740-2VG



High quality solar panel uses the sun rays to charge the lantern.

- Twelve brilliant white LEDs for a brighter light than most gas mantle lanterns
- Eight hour run time on a full charge
- Ideal for camping, outdoor entertaining or anywhere you need extra light
- No batteries needed

Includes car and household adapters; Dimensions: 9-1/4"H x 6 1/2" diameter
\$25 + s/h Note: Does not put out very much light

Propane Lantern - Coleman



\$30 1-2lb tank (as shown will last approx 8 hrs)

2 lb tanks cost \$3 ea (can be refilled from a larger tank, IE 20lb tank). Need spare mantles.

Gets very hot. Can break easily. 20lb tank would last only 80 hrs – approx 20 days



Pewter Oil Lantern 10 inch

Oil lasts several hours. Smells and puts off smoke.

Logan's maximum storage limit of lamp oil, including kerosene and diesel, is 60 gals.

\$63 Λ



#90 D-Lite from Lehmans.com

A favorite among our Amish customers since 1913. Output: 4.4 cp, Burns 26 hrs., Tank: 31 oz., Size: 13"H, 2½ lb, clear globe.

3790BG Black with Gold D-Lite Lantern \$17.95

Old-Style Table Lamp

Economical and elegant

A large, solid lamp that's efficient, dependable and affordable enough to place one in every room of the house.

- Simple design is reminiscent of 19th-century parlor lamps that were a necessity before electricity
- Chimney has charming scrollwork design and the words, "Home Sweet Home"
- Octagonal, clear glass font gives stability
- 7/8"W wick emits a steady, bright light
- #2 brass burner, 6"OD base, 18"H, 4 1/2 lb
- Imported

1050115 \$19.95



KleanHeat Lamp Fuel

Using your oil lamp should be easy and convenient. KleanHeat fuel burns without smoke or odor and travels up the wick quickly and easily. It is a little bit more expensive than some fuels you can buy, but we think it's worth it. Made primarily for kerosene heaters but works great in oil lamps. A clear alternative to kerosene. (Kerosene has an odor some people don't like.)



52243 KleanHeat, 120 oz. jug, 7 lb \$14.95



Do You Like Living In the Dark? (Or Being Cold)

Garth Turley
April 2009

Generators – 1st Choice

- Use to run furnace
- When possible, the home's central heating system should be returned to operation. A standby electric generator is a good investment. It can assure electricity to run the natural gas/LP furnace's fan and controls.
- Never run generators indoors; they produce large amounts of toxic carbon monoxide
- Pros: Small space required, allows running multiple household appliances, depending on unit's size
- Cons: Requires fuel storage depending on type of generator (gas, propane, diesel), produces carbon monoxide, noisy although muffler can help, can be expensive depending on size/type

Gas Generators

- **Easy to handle – no setup, just plug in**
- **Many sizes and types 800 watts – 10,000 watts**
- **Prices range \$400 on up**
 - Coleman
 - Honda
 - Yamaha
 - Generac (Home Depot Generac 5500 w \$797)
- **Portable or Fixed Site**
- **Gas to run**

Examples of Portable Generators:



Honda EM5000S \$2700 (noisy)



Honda EU2000i \$1080
(very quiet)



Yamaha EF2400iS \$1090 (very quiet)

Just remember that like the saying goes “you get what you pay for”. Buying an inexpensive generator, means you’ll get a generator, that a) won’t last long b) will not produce a good power wave and therefore may not run some sensitive electronic appliances.

How to Size a Generator

Add up all the desired appliances you wish to run at the same time (you can always turn on/off appliances as needed). If they have a motor or compressor you need to multiply that number by 4 for the “startup” value (motors and compressors have a startup number that is 4 times as high. If the generator is not large enough and the motor/compressor does try to start but can’t, it will burn up the unit). Once the unit has started or running you can now use the number provided in the chart.

Generator Sizing – Example Calculation

Determine the wattage of the desired appliance. This information is usually provide on a nameplate on the back of the appliance (a sample chart is located in the appendix). If only “amps” are provided, multiply the amps by 120volts to get the watts. Example: 10 amps x 120 = 1200 watts. If only the horsepower (hp) is provided, multiply the hp by 746. Example 1/4 hp x 746 watts/hp = 186 watts

Generator Example: (using the appliance chart located in the appendix)

Refrigerator 20cuft	800 watts x 4 (has a compressor)	3200 watts
Furnace	500 x 4 (has a motor)	2000 watts
Lights – 10 lights w/ 1 60 w bulb each		600 watts
	Generator Size Needed	5800 watt

Once the refrigerator and furnace are running the load will be only 1900 watt, You can then add more lights or run the micro wave. However, keep in mind that both the refrigerator and furnace cycle on and off, so you must have the generator “unloaded” or “baseloaded” when the units cycle back on again.

Generator Safety

Every generator emits carbon monoxide (CO). Only operate a generator outdoors (even operating a generator in the garage can allow CO into the home) in a well-ventilated, dry area, away from air intakes to the home, and protected from direct exposure to rain and snow, preferably under a canopy, open shed or carport. A generator does produce enough electricity to KILL you, so follow all safety rules and procedures.

How to Connect a Portable Generator

Plug in Method

The easiest connect is to plug in what you need. Unsure the generator is located in a safe place outdoors (see Generator Safety above). Run extension cords inside to each device. Make sure the cords are sized large enough to handle the device and only as long as needed (long extension cords

will cause a “voltage drop” and may not provide adequate voltage to the device). A #16 cord is good for 1100 watts, #14 cord is good for 1650 watts, a #12 is good for 2200 watts (see “Wire Gauge” chart located in the appendix for help in sizing cords with lengths). Most appliances have a cord that can be plugged in (even most microwaves have them. Look in the cupboard above the hanging unit). The exception is the furnace. However, a backup plug can be added to a furnace for emergency use for about \$100 (contact your local furnace technician, or electrician). For lighting, use portable lamps.

Panel Connection

Due to the safety and liability of this method I must recommend that only a qualified electrician should perform this connection. However, if you are going to do this, for safety, you **MUST** disconnect or turn off your main breaker. If you do not, it could result in a “backfeed” onto the utility system. During an outage the utility workers will naturally assume that the power lines are off. The results could be electrical shock even death to a utility worker.

Standby Generator

Standby Generator

This type of generator has a “fixed” location (IE is not portable) and is installed right to the house system in a safe manor. When a power outage occurs, the generator is started (manually or automatically) and fed into the house electrical wiring (also manually or automatically). These system cost more but offer the peace of mind that little is required to be “up and running” other than “throwing a couple switches”. These systems are installed by qualified electricians and need to be approved by your utility to ensure safety. The other advantage of these systems is various fuel options are available: Gasoline, diesel, propane, natural gas, etc. Disadvantage is they are expensive. A 8000 watt system with installation can cost \$5000 and up.



Power Inverters/Battery

- A power inverter can be a lifesaver if you need to heat up formula for your baby or chicks, or have to power up an incubator or hospital cage during an electric outage. This is a small electrical device that converts DC current, from a car cigarette lighter or a battery, into 110 AC current. It enables you to use a common electrical device or appliance in your car or any place that has access to a 12 volt battery. Power inverters can be purchased in a computer store,

camping/recreation vehicle stores, in marine supply stores or online. They cost from \$50, for a simple 100 watt unit, up to several hundred dollars for large units that will enable you to use electric appliances and provide power for up to 24 hours.

- The 100-watt unit allows you to heat several normal-sized heating pads. Average heating pads use 25 watts. Wrap these heating pads up in towels and place them in a bed, the bottom of a pet carrier or incubator, etc.

- Accessories: To use this item in your home, you can buy an accessory for the power inverter - a detachable set of miniature jumper cables that cost about \$5 to \$10. This cable allows you to bypass plugging the power inverter into your car's cigarette lighter and enables you to hook up directly to any 12 volt battery. An extra, fully charged car battery is inexpensive and will work for 6

to 12 hours, depending on what you plug into the inverter and how much electricity that device uses. You can purchase small rechargeable electric batteries that will last for 6 hours each. They are compact, about one third the size of a car battery, and really add to the portability of your power inverter. They last for years and are well worth the extra cost. Expect to pay between \$80 to \$100 dollars for one of them.

- Multiple Batteries: If you anticipate lengthy outages, multiple batteries are recommended to extend the length of time that you can provide power.
- Larger Units: If you have larger power requirements, a 400 watt power inverter would be advisable. They cost hundreds of dollars less than a gasoline generator but handle the same electrical capacity.
- Suggestions: Powerpack by Xantrex – 600 watt AC inverter (internal) surge/ 400 Watt sustained, with 28 amp/hr battery, 3 AC sockets 1 DC socket, recharged by AC or DC so can recharge from a solar panel, jumper cables, AM/FM clock radio, alarm clock, built-in light; MSRP \$229, Amazon \$140, use super saver shipping

Appendix

This chart is only a generalization of typical appliances. Each appliance is a little different, so check the nameplate on each for accuracy.

Energy Usage

<u>Appliance</u>	<u>Energy (watt)</u>
Refrigerator – w/ frostless freezer	
16 c.u. ft	600
20 c.u. ft	800
26 c.u. ft energy star	500
Freezer	600-1000
Dishwasher	1200
Furnace	500
Range	12,200
Wash Machine	525
Computer	250
Food Blender	300
Micro Wave	1450
Slow Cooker	200

Use this chart to determine the size of extension cord, based on the load and length needed. Always, the bigger and shorter the better.

WIRE GAUGE CHART						
Cord Length	Amperage Rating (found on motor-housing face plates)					
	0-2 Amps	2-5 Amps	5-7 Amps	7-10 Amps	10-12 Amps	12-15 Amps
25 Feet	16 Gauge	16 Gauge	16 Gauge	16 Gauge	14 Gauge	14 Gauge
50 Feet	16 Gauge	16 Gauge	16 Gauge	14 Gauge	14 Gauge	12 Gauge
100 Feet	16 Gauge	16 Gauge	14 Gauge	12 Gauge	12 Gauge	
150 Feet	16 Gauge	14 Gauge	12 Gauge	12 Gauge		
200 Feet	14 Gauge	14 Gauge	12 Gauge	10 Gauge		