GENERATING POWER DURING A GRID POWER OUTAGE

A Practical Guide to Generators for the Home

By: TJ Elias

tjelias@yahoo.com

Contents

Introduction

The information provided in this guide is not all-inclusive. It is a collection of my research results and experiences. If you have corrections or additions, please submit them to me tjelias@yahoo.com . This is meant for personal home environments and commercial applications vary greatly from what is contained herein. Feel free to share this guide with others.

Safety must come first when applying any solutions regarding electricity and fuels. Read the owners / operators manual for information regarding the products you are using. Pay special attention to the safety warnings and maintenance sections.

Whole-home power refers to the ability to have power to the entire house. This does not necessarily mean that you can power the entire house at once but can power most things on demand such as turning a light on, using any power outlet etc. The advantage is that things like refrigerators, freezers, air conditioners, gas clothes dryers, gas water heaters will automatically be powered as needed. This can be accomplished by having an adequate load capacity generator and connecting it to the 220-volt house power feed (or to a 220-volt dryer outlet as a back feed). Essentially feeding both 110-volt phases at the same time eliminating the need to run extension cords to the various appliances as needed.

I provided advice and directions as well as trained several friends and neighbors on generator setup, operation and maintenance during the recent hurricane that hit Houston. Most of us cannot justify the purchase of a standby generator. I am writing this guide because the information is fresh in my mind and others have asked me for advice and direction moving forward. I will update this guide as things come back to my mind and I get feedback from those that read it.

I do not hold any interest in the products, services or brands mentioned in this guide.

Why get a generator?

Most people are fine without power for a few hours, even a day. The more time that goes by without power the more difficult life can be.

- Preserving refrigerated and frozen food is at the top of most people's list, especially for families with children. It is a source of food and can represent a significant dollar investment
- Cooking food to survive is another reason to have a generator. Many times, restaurants are not open because of lost power. Outside grills are a great place to cook, but not all things can be cooked on a grill
- Preserving medications that must be stored cold as well as having some pet breeds that are sensitive to heat is another motivating factor
- Creature comfort becomes a larger priority as the days wear on. High temperatures and humidity get old after a while. It can be hard to sleep without air conditioning or fans

Generators

There are several generator types or classes available for personal use. The notable options are portable inverters, portable generators, portable whole home generators, and standby generators.

Operating costs for generators are in a section below.

Generating Power

Note: Most apartments do not allow running generators. Portable Power Packs may be a viable option in this case.

Power bank

Description: Handheld battery pack that be used to charge USB devices (cell phones).

Cost: $10-$100

Overall opinion: These are recommended, but not for the purpose of providing meaningful power during a power outage.

Portable power station

Description: A battery pack that produces 110-volt AC power that can run anything that plugs into a standard 110-volt AC power outlet in a house. It does not create power; it converts DC power from the energy stored in its battery to home AC power. The batteries must be charged externally.

Cost: $500-$1,000

Pros: Lightweight, small footprint, no need for fuel, can be pre-charged, can recharge from a solar cell (Slow recharge), silent operation.

Cons: Must be charged prior to use

Load capacity: 1KW-2KW

Fuel Sources: N/A (externally charged battery)

Best used for: Charging cell phones and tablets and small fans. Perhaps for those who live in an apartment or for very short power outages. Camping is also of great use for this type of device.

Average runtime: Until the internal battery dies, typically < 4 hours with 50% load.

Overall opinion: Technically not a generator. Not a practical solution for the intended audience of this guide. They work more like a UPS (Uninterruptable Power Supply) than a sustainable power source. They will typically not keep up with any notable power demand.

Portable inverter

Description: An engine powered DC generator that uses electronic circuitry to convert DC to 110-volt AC.

Cost: $300-$1,500

Pros: Inexpensive, small footprint, fuel efficient, daisy chainable, quieter than generators.

Cons: Gasoline only, lower load capacities.

Load capacity: 1KW-5KW

Fuel Sources: Gasoline (, propane, or natural gas if equipped) (Dual-fuel or Tri-Fuel)

Best used for: small load needs, can power a refrigerator, some fans and lights. Larger capacity units can power portable air conditioners.

Popular Brands: Many

Overall opinion: Technically not a generator. Daisy chaining can be used to combine multiple units for more load capacity, but fuel costs and noise also increase because of running multiple engines.

Portable generator

Description: A generator that can be stored easily and brought out when needed. They may be equipped to run on multiple fuel types. They can have multiple extension cords plugged in for various devices.

Cost: $500-$1,500

Pros: Moderately inexpensive, easy to maneuver

Cons: Large footprint for placement and storage.

Load capacity: 3KW-15KW

Fuel Sources: Gasoline (, propane, or natural gas if equipped)

Best used for: General purpose appliances and devices as well as air conditioning.

Popular Brands: MANY. I have found that Champion and Ferman are great (as are many others).

> Personally, I am not impressed by the small Generac model that I set up (it was a lower cost and did not provide tools, nice power cable and cover other brands came with).

Overall opinion: Best option for occasional needs for the basics, keeping in mind that getting fuel needs to be factored in.

Portable whole home generator

Description: Essentially the same equipment as the portable generator above with the added capability to connect to the home power feed or back feed into an electric dryer outlet to power the entire house. The whole home is supported more by the connection on the house than the generator itself.

Cost: $1,000-$1,800

Pros: Moderately inexpensive, easy to maneuver

Cons: Large footprint for placement and storage.

Load capacity: 6KW-15KW

Fuel Sources: Gasoline (, propane, or natural gas if equipped)

Best used for: Whole home power

Popular Brands: See portable generator above

Overall opinion: best option for any needs, especially if the home is plumbed to provide natural gas and the generator has the feature to run on natural gas.

Standby power generator

Description: A dedicated hardwired, gas plumed generator that can be automatically come online in the event of a power outage.

Cost: $6,000-$10,000 (Plus installation and monitoring)

Installed cost: $10,000-$25,000 (can include: generator, gas plumbing, hardwiring to a breaker box and an automatic transfer switch)

Monitoring cost: +-$200 Year (optional) (additional maintenance services can be subscribes to as well)

Pros: Automatic operation (if equipped) and typically powers the entire house

Cons: Expensive

Load capacity: 15KW-30KW

Fuel Sources: Natural gas or propane

Best used for: Automatic whole home power

Popular Brands: Generac, Kohler, and Briggs & Stratton

Overall opinion: Best option for automated high load needs. An optional transfer switch will automate the entire power management process as needed

Home solar panels

This is included to provide practical information about this technology.

Description: An energy system marketed to reduce electric energy costs for homeowners by capturing sunlight and converting it into electricity and storing the electric energy in batteries for later use by an inverter. In many cases it may be possible with special equipment to sell excess power to an energy provider.

Cost: $20,000-$50,000

Load capacity: 2KW-8KW (each panel produces 0.4 KW)

Overall opinion: Not a viable option for power during a grid power outage because of the inability to keep up with electric needs, especially during the dark of night and rainy, cloudy daytime hours. It also does not appear to be a viable investment. The feedback I have received is they have a negative ROI in the short and long term. Some owners report that it does not save them on monthly electric costs.

Operating cost

These are general calculations. The load on the generator will cause variances in these numbers.

Most generators (other than Standby generators) are single fuel (gasoline only). Other models may be Dual fuel (Gasoline or Propane). Tri-fuel models are also available (Gasoline, Propane or Natural gas).

Cost calculations are based on the following:

Gasoline $3.00 / gallon

Propane $18.00 / 15 pound (bottle exchange)

Natural gas based on average cost found on the internet.

In addition to these costs, oil changes need to be factored in as well. Typically, the oil needs to be changed every 4 days (96 hours)

Portable inverter

	Gasoline	Propane
Max runtime	12 hours on 3 gallons	12 hours on 15 pounds
Min operation cost	$0.75/hr ($18.00/day)	$1.50/hr ($36.00/day)

Portable generator

	Gasoline	Propane
Max runtime	12 hours on 5 gallons	7.2 hours on 15 pounds
Min operation cost	$1.25/hr ($30.00/day)	$2.50/hr ($60.00/day)

Portable whole home generator

	Gasoline	Propane	Natural gas
Max runtime	12 hours on 8 gallons	12 hours on 15 pounds	indefinite
Min operation cost	$2.00/hr ($48.00/day)	$4.00/hr ($96.00/day)	$1.50/hr ($36.00/day)

Standby power generator

	Natural gas	Propane
Max runtime	indefinite	unknown
Min operation cost	$2.00/hr ($48.00/day)	unknown

Generator Maintenance

Always read the documentation supplied for your specific generator for better guidelines than the general guidelines provided there.

Pre-use

- Break-in oil – a new generator motor needs to be run for an initial period to allow the engine parts to wear together which will produce metallic byproducts. Most manufacturers recommend running the generator without a load for 5 hours on the initial oil. After that, the oil

should be changed, and the generator is ready for full duty. Strict adhesion to this is not required, but the engine should last longer if this procedure is followed.

While in use

- Periodically inspect the power cords for binding, wear, and hot ends. Any of these could lead to issues if left unattended
- Change the oil (and filter if equipped) every 4 days (96 hours) of continuous use

Long-term Maintenance

- Add fuel stabilizer (for gasoline)
- Charge the battery (if equipped)
- Change the oil yearly, even if the generator has not been used much

Preparations

- Have a few extra quarts of oil available. *Change the oil every 4 days of continuous running*.
- Have the necessary tools and an oil drain pan available
- Have fuel available. Gasoline and propane may be in short supply and hard to find/get immediately prior to and during an event
- Periodically run the generator (every 3 months) to ensure it starts and runs as normal

Generator placement

Choose a place that is dry and close to the power connection plug.

Ensure adequate ventilation to keep CO2 gases from accumulating or being directed into inhabited spaces.

These are some instances where standby generators are installed on the same outside wall where central air compressor units are installed and the central air units can push the CO2 gases up into overhead soffit vents into a house, which can cause a dangerous accumulation of CO2 gases in the house because the CO2 gas is heavier than air and will migrate down out of the attic into the lower level living areas. (see the standby generator photo above).

Install considerations:

- Dedicated location close to fixed fuel source and fixed electrical feed.
- Optional automatic transfer switch. *Manual transfer switches are also available, but not required.*

Operation

Dos:

- Exercise safety practices always while handling and operating generators.
- Check cords frequently to determine if they are becoming hot. *This may indicate too much load on the power cord*.
- Change the oil per the manual. This can make the generator last many years vs seasons. *I have an old generator that is about 20 years old that still runs and does not burn oil.*
- Have a fire extinguisher handy

Don'ts:

- Do not run an engine in a closed area. (House, garage or closed patio or porch with poor air ventilation. *People die too often during events because of this.*
- Do not add fuel to a generator while it is running. Fuel my combust from heat or spark. *Many houses burn down during events because of this.*
- Do not overload the power source. The engine will typically bog down with high loads. In cases where an air conditioner initially starts, it is normal for the engine to have a short bog. Sustained engine bog may indicate too much load is on the generator. On lower capacity units, avoid hair dryers, air fryers, microwave oven, toasters, etc.
- Do not daisy-chain too many extension cords in series (plugged into each other)
- Do not use extension cords with small wires (low load capacity)
- Do not operate the generator in rain or conditions it will get wet. This can cause issues with the electrical wires and potentially cause damage to the unit if cold water hits hot generator parts, especially the hot engine block.

Best practices

- Place CO2 detectors near floor level on all floors inside a house. *They can detect the presence of improperly vented fossil fuel exhaust.*
- Let the generator cool for 5-10 minutes before adding fuel to prevent fuel combustion.
- Let the generator cool for 5-10 minutes before changing the oil to prevent burning yourself.
- Change the oil (and filter if present) every 4 days of continuous use.
- Lock generators in place with a chain, they are popular theft items, especially during an event.
- Keep extra oil on-hand so it can be changed as needed during an event when oil may be difficult to purchase.

Shutdown

- Leave existing oil in the generator if the oil has not been used more than 4 days. *Putting new oil in an engine then storing the engine for an extended period is a waste of oil.*
- Connect the battery to a trickle charger to keep it from being dead when needed. *Most battery start generators will charge the battery while running*

Short term storage (gasoline) (up to 3 months)

This is a recommended method for the storm season.

- Run the generator for 15 minutes, stop the fuel to the generator and let the generator motor die. *This will empty the fuel in the carburetor, preventing it from varnishing the innerworkings*. (Consult the manual, most generators have a fuel shutoff valve)
- Leave remaining fuel in the generator gasoline tank
- Keep remaining fuel in gas cans
- Adding a fuel stabilizer is never a bad idea

Long term storage

Option 1

- Drain fuel from the generator tank and use it for other purposes
- Use remaining fuel in gas cans for other purposes

Option 2

- Leave the fuel in the generator (with stabilizer added)
- Run the generator 10 minutes every 2-3 months with a load, letting it die by shutting off the fuel to the carburetor
- After 2 years, see Option 1

Additional information

Watts and Amps

KW (Kilowatt) 1,000 watts (Watts are the unit of measure for Power)

AC (Alternating Current) Type of energy available from home electrical outlets.

DC (Direct Current) Type of energy available from batteries.

The formula for computing watts is **Volts * Amps = Watts** (*110 volts * 5 amps = 550 watts*)

The formula for computing amps is **Watts / Volts = Amps** (*550 watts / 110 volts– 5 amps*)

Typical loads

(Consult owner's manuals for power requirements for the devices being plugged in).

The more load on the generator, the more fuel it will consume. Typically, it is best to keep the running load no higher than 60% of the running power rating of the generator. This allows for startup surges with inductive loads (AC units, refrigerators, freezers, etc.)

3KW can usually power a refrigerator, freezer, portable air conditioner (or small window AC), a fan or two and charge a couple of cellphones, watches, tablets, and laptops.

6KW can power twice the number of items mentioned for the 3KW units, including microwave ovens and hot plates.

10KW can power 3-ton central air conditioner, microwave ovens, pool pumps, gas clothes dryers.

20KW can power 5-ton central air conditioners, electric clothes dryers, clothes washers, air fryers, toaster ovens, hair dryers, curling irons, etc.

A few items that are a large load include: Hair dryer, hair straightener, curling iron, clothes iron, electric clothes dryer, air conditioner, space heater, bread toaster, hot plate, microwave oven, washing machine, and pool pump.

If large loads are used, manage them by running only a few at the same time.

I helped work with a small business that used a 6.5KW generator to power a large ice machine, 3 freezers, 2 refrigerators, 2 large screen TVs w/satellite receivers, several medium fans and several phones charging for days without issues. Your milage may vary.

Fuel sources

Providing fuel to a generator is a key component and often the most frustrating part of operating a generator. When the demand for gasoline or propane is high, the lines at the places that have them are long. When gas stations do not have power, they cannot sell gas.

Generating Power

Basic generators run on gasoline.

Dual fuel generators run on either gasoline or propane.

Tri-fuel generators run on gasoline, propane or natural gas.

Gasoline
It is the most common fuel source used by most generator owners, it is affordable and widely available (except when the demand is high during an event). It also produces the most power from a multifuel generator. It is recommended to get a supply of gasoline when an event is imminent, waiting until the event arrives will create higher demands.

Gasoline stored more than 3 months needs to have a fuel stabilizer added to it. It will go bad and gum up (will also develop a strange smell).

Gas in a container or tank may collect water condensation over a long period of time. If this happens, add a few ounces of rubbing alcohol to the gasoline. It will bond with the water and as the alcohol evaporates, the water will evaporate with it.

For generators that have been used for years and may have carbon build up inside the engine, I recommend using Sea Foam fuel additive/stabilizer. When the engine runs, it will help clean the internals of the engine. If you use more than specified, that is fine. The worst that will happen is it may put out some white smoke from the exhaust until the carbon is gone.

Most of the gasoline available today is an ethanol blend, up to 15% ethanol is fine for small engines, **E-85 (85% ethanol) is <u>NOT</u> fine for small engines and <u>WILL</u> damage the engine**.

Propane
In some cases, a convenient fuel source if the generator is equipped to use it. Various propane bottle sizes are available. This may be a good option if natural gas is not available. They can be filled at many of the ACE Hardware stores and U-Haul locations. The small bottles (15 pound) can be purchased or exchanged at many places including grocery stores, Lowes, Home Depot etc.

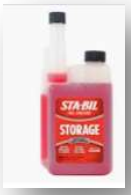
Natural gas
The most convenient and reliable fuel source. It is typically always available during events and removes the need to forage for gasoline or propane. For portable generators, a ¾" gas feed is good and can come from a gas dryer feed or from the gas meter. This gas line can also be used for a natural gas grill (when not being used by a generator). Produces the least amount of power from a generator and makes the generator noisier than gasoline.

Standby generators typically require a 1" gas feed which needs to come from the gas meter.

Solar
A free but inefficient energy source that is not always available.

Fuel stabilizers

An additive for gasoline that will extend the amount of time fuel will remain good. Depending on the exact product used, it can preserve gasoline for 2 years. (Read the product label). **Sea Foam** is also a great stabilizer that provides other benefits. I recommend it. These are available almost everywhere (Walmart, Lowes Auto Parts stores, etc.). Stabilized fuel should be repurposed after 2 years. Non-stabilized fuel should be repurposed after 3 months.



Oil

All generators use basically the same type of oil. The generator manual will provide guidance.

30w small engine oil is fine. It is also fine to use 10w30 (or 10w40 in a pinch).

Some of the higher end units recommend 5w30.

When changing the oil, pour the old oil into the empty oil bottle (after the oil cools a bit).

Old oil can be taken to an auto parts store where they will collect it to be recycled.

Automation

Electric start is a bonus of many generator operators, no need to pull a cord to start the generator. Most new generators will start with 1 or 2 pulls when they are new and properly maintained. As they age and small lapses in maintenance occur, the pull start method can be a challenge. Take this into consideration when deciding which generator to purchase. The electric start option is available for all generator types. Electric start generator will come with a battery.

Automatic transfer switches are most useful with standby generators. Since they are always on standby, they can manage the power automatically. They cost about $700-$1500 plus installation.

For portable generators, a **manual transfer switch** makes a lot more sense but is not needed for most installations. Without a transfer switch, the main breaker must be manually switched on and off as needed.

Power connectivity

Efficiency is defined as more of the available power reaching the load, resistance reduces power to a load and causes the wires to heat

- The shorter the power cord the more efficient it is
- The thicker the power wire the more efficient it is.
- The less connections in the power cords the more efficient it is.

Recommendations

- Refrain from linking multiple cords together if possible (reduced efficiency occurs when chaining cords)

- Refrain from using power splitters, surge strips and mini extension cords for larger loads

- Use thicker extension cords where possible, especially for loads that use more power (ie. A refrigerator is a larger load than a fan)

Trickle charger

A device that is connected to a battery to keep it charged. The better-quality devices will help extend the life of a battery. They can be used to reduce the hassle of periodically manually charging the generator battery. They cost $15-$80.

CO vs CO2

Humans and animals exhale CO (**carbon monoxide**) gases when breathing as part of the oxygen to blood exchange. This is a harmless gas in normal concentrations.

Combustion engines create CO2 (**carbon dioxide**) gases when fossil fuel is burned. This gas is very dangerous even in small concentrations. It is colorless and odorless. It is heavier than air and stays close to the ground unless disturbed. Fans and other air movement can disturb this gas and cause it to rise higher.

Lighting

Install LED lightbulbs when possible. They use less than 1/10th the power of conventional bulbs. An LED bulb that draws 4 watts can put out as much light as a 100-watt conventional bulb.

Air conditioning

Air conditioners are a huge load for generators. The high KW models can typically handle small units. The older AC units are less efficient and will require more power.

Portable air

Central air

A soft-start module can be installed to help reduce startup surges on central air compressors and reduce operating costs.

Miscellaneous

Close window covering to reduce the solar heat getting into your home.

Retailers

Amazon, Lowes, Home Depot, Costco, Walmart. Harbor Freight, etc.

Troubleshooting

If everything is set up and maintained properly, things should go fine, except when they don't. Here are some help tips for troubleshooting generators and power related issues.

The generator manual is a great place to research issues related to malfunctions.

Keep in mind that an engine needs 4 things to run: Compression, Spark, Fuel and Air.

Gasoline leaks out

Never run a generator that is leaking fuel. This is a serious condition and will likely cause a fuel fire which can spread fast. Fuel leaks can be caused by the following:

- Cracked or broken fuel line. Replace damaged or worn items.
- Cracked or worn gaskets or O-rings. Replace damaged or worn items.
- The carburetor float is stuck open. Consult a mechanic.

Generator will not start

Unfortunately, this is a common occurrence when attempting to run a generator that has not been run in a while. This is a good reason to periodically run a generator and keep it properly maintained.

Possible reasons

Startup procedures

Ensure all the necessary steps have been followed to start the generator.

- Fuel is available (tank filled, natural gas or propane hose connected)
- Fuel valve opened (if equipped)
- Proper fuel type selected (if equipped)
- On/Off switch in the on position (if equipped)
- Choke not engaged (for cold start)
- Load connected to generator, disconnect electrical load

Dead battery

If it is electric start and the engine will not turn over or only clicks when pushing the start switch, the battery may be dead, or the connections are corroded.

- Clean corroded or loose connections
- Attempt to jumpstart a dead battery (*Same process as a car*)
- Pull the manual start cord

The conditions below may exist if the engine turns over but does not start

Old fuel

Old fuel may not burn. The fuel left in the system may be foul, try fresh fuel.

Gummed-up carburetor

Old fuel that was left in the carburetor from past use may have evaporated and left a sticky deposit behind that has fouled the inner workings. Using a fuel stabilizer greatly helps to prevent this. If this is the case, a mechanic may need to be consulted to dissemble and clean the carburetor.

Oil level too low

Check the oil level, most generators ae designed to shutdown if the oil level is low. This is by design to protect the engine

Air filter
Engines run on air; the fuel is used to make the air combustible.

- Take the air filter off and verify that it is clean. Clean or replace it if needed. *It is not recommended to run an engine without an air filter.*

Spark
If the spark plug is not working properly, the air will not combust. This could be caused by the plug, plug wire or ignition coil. It is beyond the scope of this guide to provide testing procedures. Consult YouTube or a mechanic.

Compression
It is rare that an otherwise healthy engine would not make compression, but it is possible and it typically the last thing to verify. It can be caused by issues with valves, piston rings, pistons or the engine block. Consult a mechanic if this is the only logical cause remaining.

Motor running badly

The engine is running badly or continuously surging, bogging or backfiring. Causes include loose components, vacuum leaks or a gummed-up carburetor.

- Ensure there are no loose components on the generator, especially modules and the carburetor screws
- Partially gummed-up carburetor, see above
- Backfires are not good and indicate something is not running / tuned correctly. *Backfires can damage an engine and, in some cases, cause a fire. Consult a mechanic.*

Generator stopped running

- Check the fuel level and connections
- Check the oil level
- Disconnect the load and attempt to start
- If it dies when a load is connected, reduce the load

Total loss of power

If the generator is running and there is no power to the loads

- Check all the power cords
- Check the breakers on the generator
- Check the breakers on the breaker box (if connected to the house)

Partial loss of power

If some of the loads or part of the house loses power, it is possible that a cord is partially connected or that a breaker is partially tripped. Follow the same guidance for Total loss of power above.

My setup

The system that I have in place is as follows.

- **Generator**: Champion 10,000 Watt Tri-Fuel
- **Power plug on garage**: Standard RV power receptacle
- **Fuel source**: Natural gas
- **Notable loads**: 3-ton central air, pool pump, 3 refrigerators (plus a neighbors' refrigerator), 1 standup freezer, 3 UPSs, and all other various loads in the entire house and garage like appliances, TVs and ceiling fans. All lights were available on-demand.
- I also have several UPSs (Uninterruptible Power Supplies) battery backups in place for computers and internet equipment which keep the internet functioning, unless the internet provider goes down.

My investment is: Less than $1,800

- Generator $1100 (purchased on Amazon)
- Gas outlet installation: $300 (plumbers do this)
- Electric plug installation: $300 (electricians do this)
- Electric cable for generator to house RV plug (220-volt / 50 amp): $40 (purchased on Amazon)

My action plan

These are the general procedures I follow when using my generator. Your procedures will vary (especially if you use gasoline, see the **Shutdown** section above). It is important to have an ordered plan for what needs to be done to avoid a potentially serious mistake. It may make sense to keep a printed copy of **your** procedures in a handy location for use when needed.

When the power goes out

1. Bring generator out of garage and place at back of garage
2. Connect natural gas hose from natural gas outlet to generator
3. Start generator (let it warm up while I perform the remaining steps)
4. In the house turn the AC units **OFF** at the thermostats in the hall
5. Turn **OFF** the breaker to the pool pump
6. Turn **OFF** or unplug all unneeded items in the house and garage (air compressor, pool pump etc.)
7. **At the breaker box, turn OFF the main power feed breaker to the power grid**. Largest breaker at the top of my box. (**Very important so you don't back feed the power grid and possibly injure someone or damage your generator or breaker box**)
8. At the breaker box, turn **OFF** all breakers feeding the house
9. Connect 220-volt power cord to RV plug on garage to generator
10. At the breaker box, turn **ON** the breaker to the RV plug. (this is normally turned off since I do not use it for anything else)
11. At the breaker box, turn **ON** all breakers feeding the house one at a time
12. Turn upstairs 3-ton AC unit **ON** at thermostat

When the power comes back on

1. Turn **OFF** upstairs AC at thermostat
2. At the breaker box, turn **OFF** the breaker to the RV plug. (this is normally turned off since I do not use it for anything else)
3. **Disconnect 220-volt power cord from RV plug on garage to generator** (**Ensures no back feed**)
4. At the breaker box, turn **OFF** all breakers feeding the house
5. At the breaker box, turn **ON** the main power feed breaker to the power grid. Largest breaker at the top of my box
6. At the breaker box, turn **ON** all breakers feeding the house one at a time (Check to verify power is on to something in the garage or house)
7. Shutdown the generator
8. Turn all AC units **ON** at thermostat
9. Turn **ON** the breaker to the pool pump
10. Disconnect natural gas hose from natural gas outlet and generator
11. Rollup gas hose and power cord and store is garage
12. After generator cools, store it in the garage