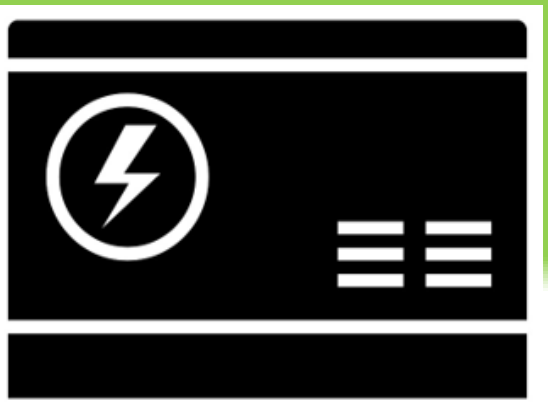
Standby Generator Sizing Guide



Although the following generator sizing guide will give you some idea of your backup generator, you should ALWAYS hire a professional to calculate your electrical load and installation needs. There is no single sizing solution for all homes. The size and power of the generator is determined by a variety of factors including the size of your home, the type of fuel preferred, and the wattage requirements of your appliances. Do not forget to also take into consideration load growth, seasonal changes, and different types of motors.

It is important to size a generator correctly. Too small of a generator for a large load can damage the generator and/or the equipment or appliances that are connected to it. Too large of a generator will cost you more by using more fuel and will be less efficient when loaded lightly. This will also typically have a larger installation bill.

CODES

Generators must be installed according to codes set by the National Fire Prevention Association (NFPA), as well as to state and local codes, to operate safely and efficiently. The installer should consult local AHJ to check codes, permitting, and regulations.

There is free access to the NFPA codes found in the links below:

NFPA 37 – "Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines"
https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=37

NFPA 70 – "National Electrical Code"
https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=70

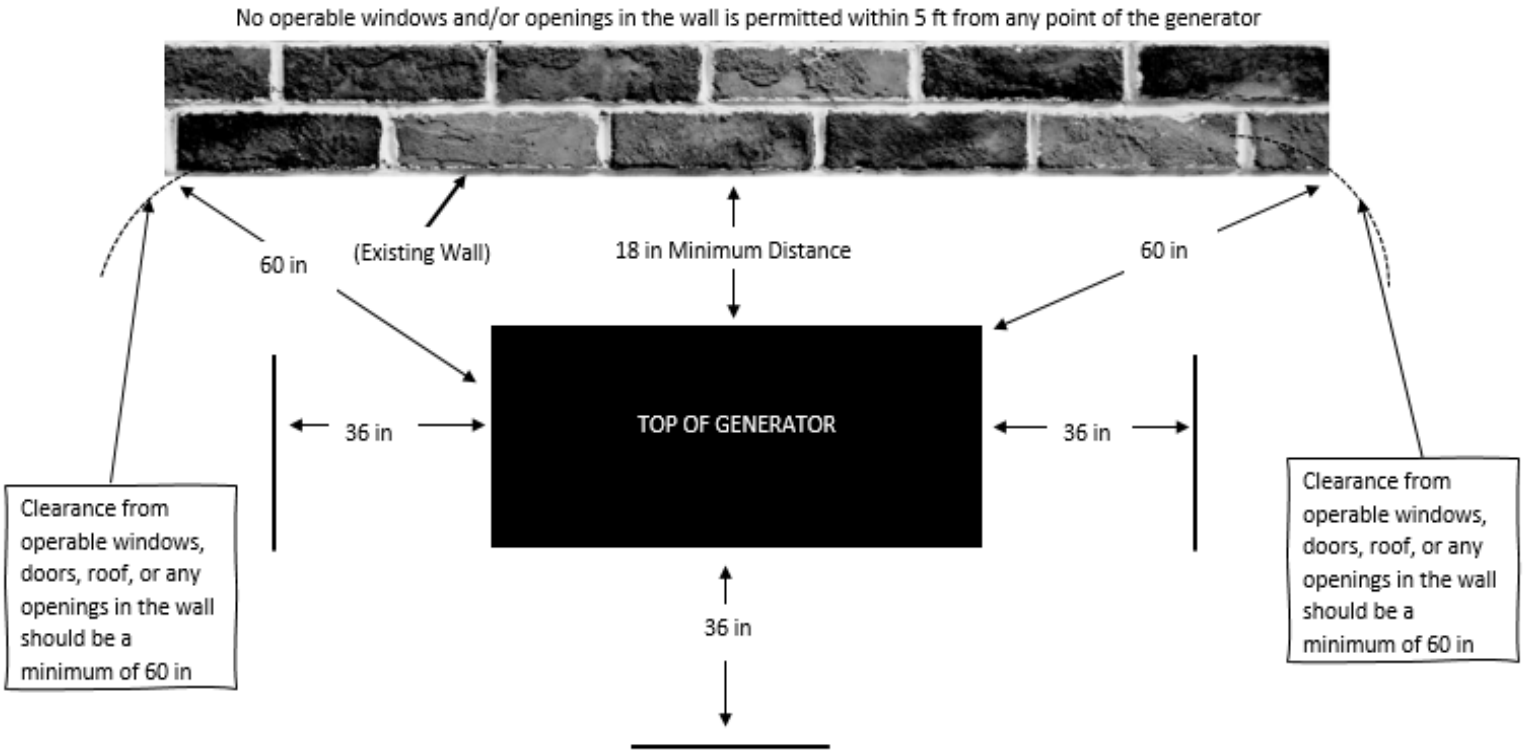
NFPA 110 – "Standard for Emergency and Standby Power Systems"
https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=110

Reference Codes:

NEC 225 Branch Circuits and Feeders
NEC 240 Overcurrent Protection
NEC 250 Grounding
NEC 445 Generators
NEC 700 Emergency Systems
NEC 701 Legally Required Standby
NEC 702 Optional Standby
NFPA 37 Installation & Use of Stationary Engines
NFPA 54 National Fuel Gas Code
NFPA 58 LP Gas Code
ICC Fuel Gas Code

Location

Location is often overlooked when installing a generator. The location can determine the generator size, transfer switch location, fuel type, and fuel capacity. Generators should NEVER be located indoors. NFPA 37 section 4 specifies generator clearances for outdoor installation, see figure below.



PLACEMENT CONSIDERATIONS

- Air inlet obstruction
- Exhaust precautions
- Rising water levels
- Maintenance and servicing accessibility
- Water spraying, saturating, or swamping
- Underground or covered services
- Fuel supply and pipe length
- Transfer switch proximity
- Level Surface and/or Prevailing winds

Running Watts vs. Starting Watts

Running Watts: Power that the generator can supply all the time. Also called rated watts or continuous watts.

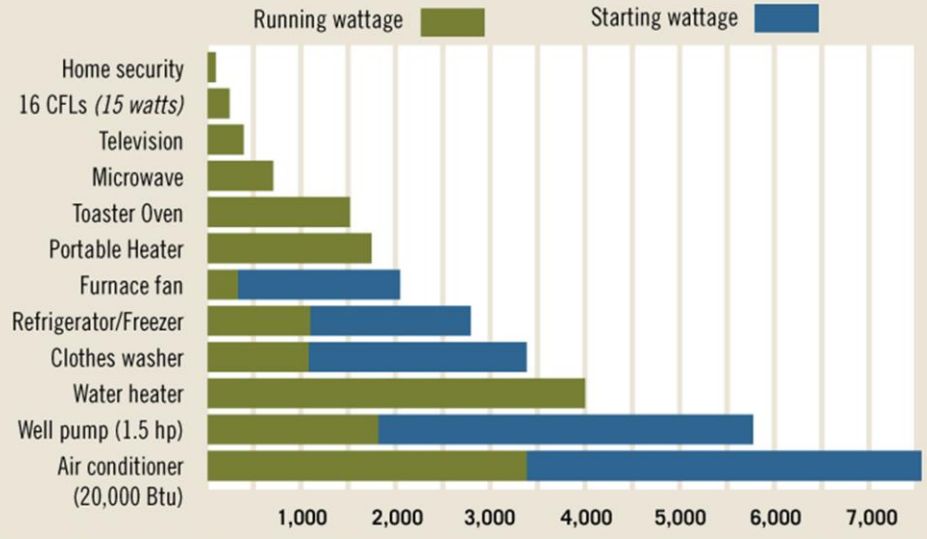
Starting Watts: Extra watts needed for two or three seconds to start motor-driven products like a refrigerator or circular saw. This is the maximum wattage the generator can produce. Starting watts are also called inrush current, surge watts or peak watts.

- **On the appliance nameplate, look for LRA (Locked Rotor Amps). This is the current you can expect under starting conditions when full voltage is applied. Multiply the LRA by the voltage to get your starting wattage.**
- **Another way to find starting wattage or inrush current is to get a good quality clamp amp meter that can measure the inrush current. Simply attach the amp meter to the appropriate wire, select the "inrush" function of your amp meter, and start your appliance to get a reading. Multiply the amps by the voltage to get the wattage.**

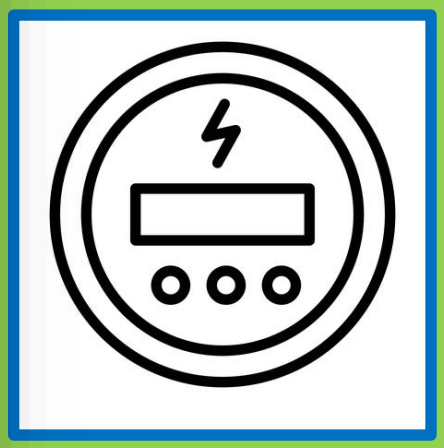
The Right **Portable Generator** for the Job

Before purchasing or operating a portable generator, make a list of the appliances you will need to run at the same time. Find both starting and running wattage requirements on appliance nameplates or in owner's manuals; add them up to determine the total wattage your generator should handle.

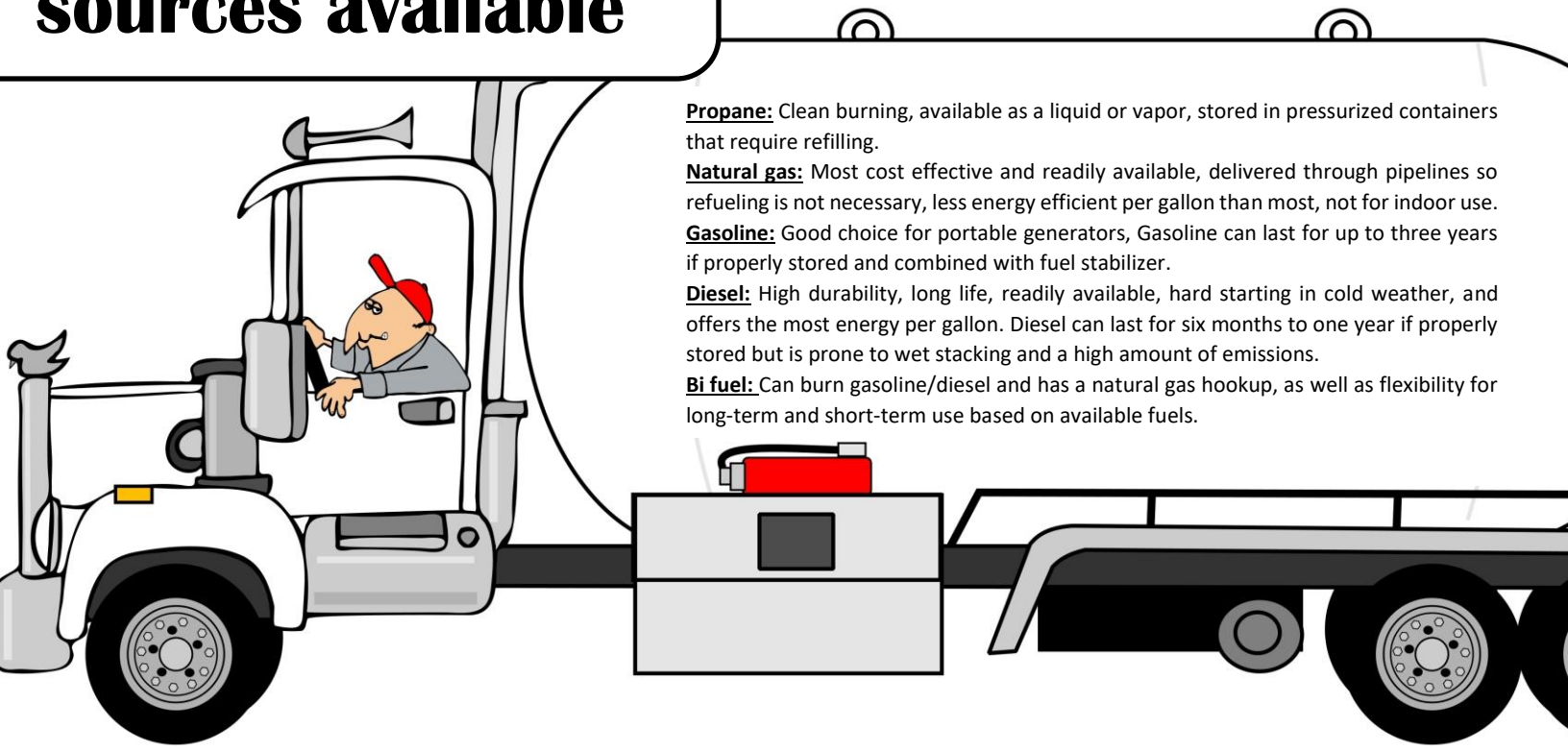
Sample running wattages, as compared to spiked starting wattages:



Sources: North Carolina Association of Electric Cooperatives; National Rural Electric Cooperative Association



Determine fuel sources available



Propane: Clean burning, available as a liquid or vapor, stored in pressurized containers that require refilling.

Natural gas: Most cost effective and readily available, delivered through pipelines so refueling is not necessary, less energy efficient per gallon than most, not for indoor use.

Gasoline: Good choice for portable generators, Gasoline can last for up to three years if properly stored and combined with fuel stabilizer.

Diesel: High durability, long life, readily available, hard starting in cold weather, and offers the most energy per gallon. Diesel can last for six months to one year if properly stored but is prone to wet stacking and a high amount of emissions.

Bi fuel: Can burn gasoline/diesel and has a natural gas hookup, as well as flexibility for long-term and short-term use based on available fuels.

Generator Sizing Instructions

There is not a single correct sizing solution. The following are several methods that, when mixed with good judgement, should result in an appropriately sized generator. Remember to consider load growth, seasonality, and effects of starting motors.

Remember: Never add Amps when sizing a generator. Convert Amps to kW and add kW to determine the required generator size. Adding Amps without properly accounting for the power factor and/or mixing voltages will result in improperly sizing the generator.

Partial House (Essentials) Load Summation Method

Make a list of all items you wish to power at the same time during an outage. Be realistic but inclusive.

1. Using the Wattage Chart below, fill in the running watts and starting watts requirements on the 'You Power Needs' section. (See example below)
2. Add the Running Watts of the items you wish to power. Enter this number in the 'Total Running Watts' column.
3. Select the individual item with the highest number of starting watts. Take this one number, add it to you Total Running Watts, and enter it in the Total Starting Watts box.

EXAMPLE

DESCRIPTION	RUNNING WATTS	ADDITONAL STARTING WATTS
1. Refrigerator/Freezer	700	2200
2. Furnace Fan Blower – 1/2 HP	800	2300
3. Washing Machine	1150	2250
4. Range Oven/Stove Top	8000	0
5. Sump Pump 1/3 HP	800	1300
6. Well Pump 1/2 HP	1050	2100
7.		
	TOTAL RUNNING WATTS	HIGHEST ADDITIONAL STARTING WATTS
	12500	2300
TOTAL RUNNING WATTS + HIGHEST ADDITIONAL STARTING WATTS =		
TOTAL STARTING WATTS NEEDED		14800

With this example, you need a generator that produces at least 12,500 Total Running Watts and 14,800 Total Starting Watts

I need a generator that produces at least _____ total running watts and _____ total starting watts.

YOUR POWER NEEDS

DESCRIPTION	RUNNING WATTS	ADDITONAL STARTING WATTS
1.		
2		
3.		
4.		
5.		
6.		
7.		
	TOTAL RUNNING WATTS	HIGHEST ADDITIONAL STARTING WATTS
TOTAL RUNNING WATTS + HIGHEST ADDITIONAL STARTING WATTS =		
TOTAL STARTING WATTS NEEDED		

Wattage Chart

DESCRIPTION	RUNNING WATTS	ADDITONAL STARTING WATTS
ESSENTIALS		
Light - 60 watt	60	0
Deep Freezer	500	1500
Sump Pump 1/3 HP	800	1300
Well Pump 1/2 HP	1000	2100
Electric Water Heater	4000	0
General Lighting & Receptacles per 1000sq ft	3000	0
HEATING / COOLING		
Space Heater	1800	0
Furnace Fan Blower – 1/2 HP	800	2300
Furnace Fan Blower – 1/3 HP	700	1400
Window AC – 10,000 BTU	1200	3600
Window AC – 12,000 BTU	3250	9750
Central AC – 10,000 BTU	1500	4500
Central AC – 24,000 BTU	3800	11400
Heat Pump	4700	4500
Electric Heat per 1000ft^2	12000	0
LAUNDRY ROOM		
Washing Machine	1150	2250
Clothes Dryer – Electric	5400	6750
Clothes Dryer – Gas	700	1800
KITCHEN		
Refrigerator/Freezer	700	2200
Microwave Oven – 625 Watts	625	0
Microwave Oven – 1000 Watts	1000	0
Coffee Maker	1000	0
Electric Stove – 8 in. Element	2100	0
Dishwasher – Hot Dry	1500	0
Range Oven/Stove Top	8000	0
OTHER		
1/2 HP Garage Door Opener	875	2350

* The wattages listed in our reference guide are based on estimated wattage requirements. For exact wattages, check the data plate or owner's manual on the item you wish to power.

Whole House – Measurement Method:

Connect a recording ammeter or power meter that can measure the maximum peak kW demand continuously over a thirty-day period. The maximum kW demand should be taken while the building is occupied and should include the larger of the heating or cooling loads.

The peak kW demand should be multiplied by 125%

*Calculated kW demand = Peak kW demand * 125%*

Size the generator to the next standard size.

Whole House – Billing History Method:

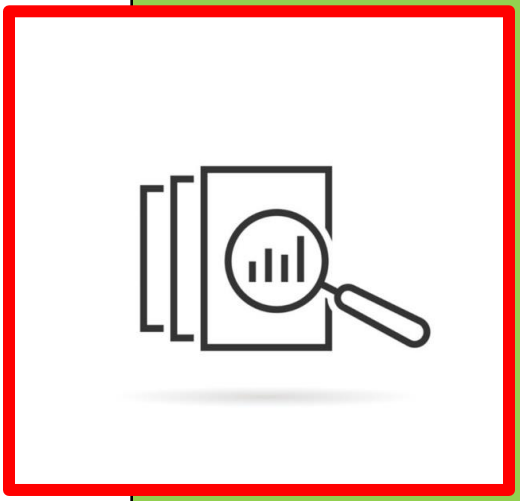
Using a year's worth of electric bills, size the generator to 25% larger than the largest peak demand. Peak demand is simply the average electrical usage that has occurred over a 15-minute period.

You can find your peak demand one of three ways:

1. Website, by logging onto your account www.fallriverelectric.com />My Usage>Select a year's worth of data>Change the chart to 'Peak Demand.'
2. On your monthly bill, your peak demand is listed for that billing period.

DEMAND:	READING
	12.930

3. Call one of our friendly member service representatives at (800) 632-5726 and request your demand for the year.



The EASY Way – Home Standby Generator Sizing Calculators:

Generac

https://www.generac.com/for-homeowners/home-backup-power/build-your-generator

Briggs & Stratton

https://www.briggsandstratton.com/na/en_us/buying-guides/standby-generators/choosing-standby-generator.html

Kohler

http://www.kohlerpower.com/home/home-generators/selector#your-home

Choosing a Transfer Switch:

Choosing a Transfer Switch:
An automatic transfer switch (ATS) is a self-acting, intelligent power switching device governed by dedicated control logic. The principal purpose of an ATS is to ensure the continuous delivery of electrical power from one of two power sources to a connected load circuit.

Load Center Automatic Transfer Switch: When only powering partial (essential) circuits to your home, you will need a load center (panel) that you can land each individual breaker that feeds each circuit that you have chosen, as necessary.

Service Rated: When powering your whole house with a generator, you will use a service rated ATS. This is typically located in between the utilities meter and your main panel.

Safety Considerations:

- Potentially lethal voltages
- Comply with ALL codes and standards
- Gaseous fuels are highly explosive
- Parts are rotation and/or hot
- Carbon monoxide (CO) odorless, colorless, poisonous gas

FALL RIVER
RURAL ELECTRIC COOPERATIVE
Where Service Matters