Power To The People!

The Sands Point Guide to Back-up Generator Systems

Following the protracted power outages in the Village caused by Hurricane Irene, many residents have inquired at Village Hall about purchasing standby generator systems for their homes. There are many such generators already in operation here in Sands Point and the owners of these systems have been very pleased with the additional security and convenience they provide, so long as they are regularly maintained and tested so as not to fail to work when needed.

If you are interested in possibly installing a standby generator for your home, be aware that every installation is unique and professional assistance will be required. The purpose of this document is to provide a helpful introductory guide to supplement, not replace, professional guidance.

First off, a permit issued by the Village Building Department will be <u>required</u> before you can install a generator. This is to insure that the installation is safe for both you and your neighbors. Generators require both fuel and electrical connections that are well beyond the scope of any do-it-yourselfer and must be designed and installed by professionals for your safety.

A complete standby generator system is made up of three parts: the **fuel supply**, the **generator** itself and the **transfer switch**. Let's deal with these one at a time.

Fuel Supply Alternatives

While the engine of a generator may be designed to run on gasoline, diesel fuel, propane, or natural gas piped from the street, the preferred choices for most systems are either natural gas or propane. Because large diesel/gasoline tanks at a residence are very heavily regulated and require a great deal of safeguards to prevent leakage from becoming a significant environmental and health hazard, diesel or gasoline systems that operate automatically are impractical because of fuel storage limitations.

Gasoline

At the low end of the cost spectrum, small "portable" and self-contained gasoline-powered generators with internal fuel tanks are an option chosen by some residents who are willing to put up with inconvenience of manual operation and anticipate being home at the time of the power outage. Such "portable" units are about the size of a wheelbarrow, are usually mounted on wheels and can be rolled short distances; they are a common sight at construction sites. In many ways they are similar to a gas lawnmower with an electric starter and can be stored in a garage. Most generators of this type will run less than a full day on a tank of gas, requiring the resident to refill the gas tank at least once or twice a day by pouring in gasoline from a typical five gallon jerry can that must be refilled at a gas station. The generator cannot be run inside the garage safely unless the exhaust is properly vented and the garage door left open. Like lawnmowers, generators of this type have a further drawback in that they tend to be noisy. They are sufficient, however, to provide heat and hot water, keep the refrigerator running, and cover basic lighting needs during an outage so long as the homeowner is capable of starting the unit and keeping it supplied with gasoline during the outage.

It is also important to note that there can be significant quality differences between generators having the same kW rating, just as two cars containing engines of approximately the same horsepower are not necessarily comparable in quality and cost. Some gasoline engines are not well designed to run for long periods of time, and some low-end generators may not provide a consistent, well-regulated power output. Electrical appliances may be damaged by poorly-regulated electric current, so it is important to shop carefully for the best manufacturers of gasoline generators in the 8 to 15 KW range.

Natural Gas

Permanently-installed automatic generators are most commonly powered by propane or natural gas when available. However, not every street in Sands Point has undergound natural gas service provided by National Grid, the only supplier in Sands Point and most of Long Island. If there is a gas line on your street and you do not already have natural gas service in your home, you will have to pay a fee to National Grid to trench a line from your home to the street. Sometimes National Grid runs promotions and pays for the basic line installation. Your plumbing contractor must run a gas line from National Grid's gas meter outside your home to the generator location on your property. If National Grid's supply line is on the opposite side of the street from your home, National Grid will have your new gas line "shot" underneath the street to the other side without breaking up the pavement.

If your home is not a street with natural gas service but near a street that does have service or if your home is located very far from the street, National Grid may be willing to run a line to your home, but the cost can run well into the five figures. If you already have gas service powering your heat/hot water system, kitchen gas range, barbecue grill and/or pool heating system, the existing gas line from the street to your home may not be adequate to serve a large generator, in which case a second gas line and separate meter must be added to provide the additional capacity. Your generator installer will determine in consultation with National Grid if your existing service is adequate to power the size generator you are considering.

Although National Grid reserves the right in the event of a major disaster to turn off the gas for a particular community for safety reasons, instances of such turn-offs over many decades are extremely rare. In the vast majority of power-failure events that have occurred, natural gas service has not been interrupted on Long Island.

Propane

If you opt for propane (sometimes called LP) as your generator fuel, you will need to have a storage tank installed on your property. While not as complex and environmentally-restricted as a diesel/gas tank, there are considerations. Above-ground tanks must be placed carefully on your property (the village building inspector will assist you) and above ground tanks are limited to the 100 gallon variety. Typically, a 100 gallon above-ground propane tank will supply a 10kW-20kW (see ***Generator*** below) generator with 2-3 days worth of run time. However, most propane tanks in Sands Point are placed underground and have far larger capacities (500 – 1000 gallons). Again, placement is an important issue that must be addressed when planning for an installation. Unlike natural gas service, in a protracted black out without a propane replenishment delivery, you may run out of propane fuel. Propane is currently about $4.05 a gallon.

The Generator

Although the industry refers to the entire physical unit as a "generator" (or sometimes a "genset" or "power plant"), the mechanical system consists of a fuel-fired engine connected by a short shaft to the actual power generator or alternator, which is basically an electrical motor in reverse; instead of the electric current causing the shaft of an electrical motor to turn, the engine turns the shaft of the generator producing the electrical current. Control circuitry must monitor the electrical output and sometimes must vary the engine's throttle so as to match the power produced to the demand level and ensure consistency.

Almost every decision about a generator will depend on the power needs of the particular home and whether all or only some essential systems in the home are needed during power outages. Clearly a generator of sufficient capacity to allow everything electrical within the home to operate normally during LIPA outages will be more expensive and require a large fuel supply than a lower capacity system. (see "Electrical Power and Generator Capacity" below)

Simply put, how many things do you want your generator to power? Lights, refrigerators, furnaces, cook tops, washers/dryers, air conditioners, etc. all figure into what are known as demand calculations. In addition, some items (like air conditioners) require more power to start up than to run so you will certainly need to consult with a generator professional and/or an experienced electrician to select the correct size of your unit depending on your budget. It will be helpful if you make a list of what you want energized by your generator in advance of such a meeting. If the cost estimate exceeds your budget, you may decide, as an example, that you will use the generator to power heat and hot water, your stovetop and microwave and certain lights, but not the air-conditioning system and your electric double oven, which you can live without during a power failure in the summer months.

Generator size is rated in kW or kilowatts. Suffice it to say that based on the types of generators that are currently in use in Sands Point, you will most likely be looking at generators that provide at least between 10kW and 20kW of power capacity. This range will meet most demands for lighting, heating, and refrigeration. However, you may want to have even greater service capacity in the event of a power failure. Air conditioners, electric cook tops and ovens, washers and dryers all add additional demand (and kW) to your usage but these may be important to your ability to endure a prolonged power interruption and it may be worthwhile for you pay for greater generator capacity and fuel usage. There are several homes in the village that have very large (100kW+) generators that are capable of powering every electrical system in a very large house when the power goes out. Obviously the cost of such large systems will be prohibitive for most families. Smaller homes rarely need such large systems to supply adequate power for most needs during the period of the outage.

Units up to 20kW are usually air-cooled. This means the units do not have radiators (like most cars) and as a result generally do not need as much maintenance as water-cooled ones. Larger standby generators are usually water-cooled and more closely resemble engines in automobiles. Both types are very dependable but just like cars should be serviced on regular intervals as recommended by the manufacturer. It is best to arrange for a service contract which includes regularly scheduled periodic maintenance. Running a generator periodically is essential to good maintenance. There is nothing more frustrating than a generator that fails to work during a power outage

Generators should always be placed outside your home with care taken as to their location so as to minimize noise, visual impact and carbon monoxide emissions. The building inspector and your architect, engineer or generator contractor will assist you in determining where you can place a generator on your property. Remember that some properties in the village are subject to possible flooding so be certain to take this into account when situating your standby generator. Generators may be installed in remote locations away from homes but no closer to lot lines than permitted by the Village zoning code for accessory structures. Electrical cabling must be buried between the house and the generator.

Virtually all permanent residential generators are designed to run on either natural gas or propane (not at the same time) and sit on cement pads. Most have some sort of built-in noise attenuation features (generally below 65dB). Some are close to silent and cannot be heard indoors. A 10kW-20kW generator weighs approximately 450 pounds and is usually about 4’ long by 2’ wide, by 2.5’ high but are often larger due to their casing. A larger capacity 35 to 50 kW generator may be as large as 6’ tall and 8’ long, comparable in size to a small shed. Most units require air-flow clearance on all sides so they cannot be placed flush to any surface. Shrubbery can be planted around generators so long as they may still be accessed for service and air flow is not compromised.

The Transfer Switch

No electrical circuit in your home may be connected to normal power from LIPA at the same time as it is connected to a generator. The junction between the generator and your home's electrical service is the transfer switch. The transfer switch, depending on the capacity of your generator, connects some or all of your home's electrical circuits to either the generator or LIPA, but never both. The transfer switch is usually located close to the main electrical circuit-breaker panel for your home, most often in the garage or basement.

Small systems using a generator that must be started manually in the event of a power outage (such as the gasoline-powered semi-portable units described above) usually utilize a less-expensive manual transfer switch. After the generator has been started and is running, the homeowner must throw the transfer switch into the generator position and those circuits transferred by the switch can then receive the power from the generator. When LIPA power is restored, the switch must be thrown back to the LIPA position and the generator turned off.

Larger capacity natural gas and propane generators generally utilize an automatic motorized transfer switch with sophisticated circuitry and sensors. An automatic transfer switch will detect when the LIPA power fails, wait a reasonable number of seconds to determine that the power interruption is not momentary, then send a signal to activate the battery-powered starter of the generator. When it receives confirmation from the generator that it is producing power, it will activate the mechanism that moves the transfer switch into the generator position, allowing the generator's power to flow to the home circuits. It continues to monitor the incoming LIPA power line throughout the outage and when it detects that power has been restored, it activates the transfer switch back to LIPA and turns off the generator.

Some transfer switches can interface with computers and other digital systems to notify an absent homeowner that a power outage is underway and the generator is in service. The transfer switch usually contains a clock timer which "exercises" the generator once a week for a short time to maintain it in good running order and charge the starter battery, just as one might periodically start a car that is not used regularly. The transfer switch will not actually transfer the power from LIPA to the generator during such weekly tests. There are usually manual controls that allow the homeowner to start the generator and transfer the house circuits to the generator to test the system even when LIPA is providing power.

Of the three components of a standby generator system, the transfer switch is the one where advances in digital technology have been most fully realized. A modern transfer switch can effectively route generator power dynamically by using what is known as load-shedding. For example, a load-shedding transfer switch can automatically route power away from unused circuits to those that need a greater start up current (such as an air conditioner) and when it no longer needs that higher current, it returns it to the other circuit. These types of optional features cost more initially but can make a smaller generator unit more productive. Transfer switches must be carefully matched to the generator and your home circuitry.

Summary

Standby generator systems have proven themselves to be useful hedges against power failures, especially here in Sands Point. A well-designed system requires the advice and the skills of a professional. You may be dealing with electricians as well as plumbers (to make fuel connections). Costs will vary widely depending on the size of your unit and how complex it is to interface the transfer switch with your home circuitry. As an approximation, based on final cost affidavits submitted to the Village as part of the permit process, for a basic installed 10kW-20kW system you should figure on spending at least $12,000-$15,000.

You should ask for references from any home power company as well as checking with the Better Business Bureau and licensing agencies as appropriate. As with all work done by any contractor, you are ultimately responsible for getting applicable permits and inspections.

Appendix:
Background Information about Electrical Terminology and Generator Capacity

The unit of measure of generator capacity is a kilowatt (kW), or a thousand watts. Everything electrical in your home has a power requirement measured in watts, the standard unit of electrical power. A 150 watt light bulb requires twice the electrical power of a 75 watt bulb. Motorized appliances and electrical heaters are examples of devices that require many times the power of light bulbs.

Although light bulbs and appliances are rated in watts of power consumed, the electrical service to one's home and the individual circuit breakers within the electrical distribution panel are measured in amps, such as a 15 amp circuit breaker, or a home with 200 amp service from LIPA. This can be confusing, so let's look at the relationship between amps and watts.

An amp (short for ampere) is the unit of current flow, and the formula for calculating watts, which are the units of electrical power, is: watts equal amps multiplied by voltage. So one of your home's typical electrical circuits protected by a 15 amp circuit breaker has a power capacity of about 1,650 watts, or 1.65 kW (15 amps multiplied by 110 volts).

Power use is not consistent because certain types of electrical equipment, such as motors, require more power to start up than once running; perhaps you have noticed a slight dimming of a lamp when a vacuum cleaner or other motorized appliance is turned on.

Electrical capacity calculations must take into account the maximum "surge" power that an appliance or motor may require, even if for only a few seconds. That's why turning on some appliances can cause a surge above the capacity of a circuit that "flips" the circuit breaker, cutting off power to that circuit and requiring manual reset at the electrical panel.

Your electrical circuit breaker control panel contains as many circuit breakers, most of which are rated either 15 or 20 amps, as are needed to safely cover your power needs. Some high capacity circuits may require 30, 50 or 60 amp circuit breakers for air conditioning compressors and blowers, electrical ovens, electrically heated rooms or floors, etc. That's why the limited capacity of most generators does not permit all equipment in your home to be operated during a power failure. When your generator system is installed, only some of the circuits on your electrical panel will be connected by your electrician to the generator transfer switch. Those circuits that are left unconnected to the transfer switch will not be powered during an outage until LIPA power has been restored.

The electrical service capacity provided by LIPA for each home may vary. Traditionally, most homes have 200 amp service, meaning that the sum of all individual breaker circuits may not exceed 200 amps. A home with 200 amp service by definition cannot exceed about 22 kW of total power usage. Larger homes and those with multiple air-conditioning systems and pools with elaborate pump systems and accessories often require 300 or 400 amp service from LIPA. Correspondingly, the capacity of a back-up generator sufficient to power all circuits in a home must be proportionately greater if all or most circuits are to be powered when the generator is in use.