

# WHITE PAPER

## Understanding Power Outages

### Understanding Power Outages

It's not a matter of if, it's a matter of when. Your business is essential, so is your power. Power outages short-term or long-term can be detrimental. Power failures disrupt communications, water services and transportation. They may also cause businesses to shut down, food can spoil and certain electrical devices will stop working. Why does a power outage happen? Let's take a closer look.

### How Do Power Grids Work?

The power grid is the biggest appliance you use every day. We hardly think about it, but it is what keeps our country running. The power grid is a network for delivering electricity to consumers. The power grid includes generator stations, transmission lines, towers and individual consumer distribution lines.

- **Step 1: Energy is Generated**  
The generator produces energy.
- **Step 2: Energy is Converted to High Voltage**  
Convert energy into a high voltage for distribution.
- **Step 3: Distribution and Consumer Use**  
Power lines deliver power to populated areas while transformers intersect the high voltage power and convert it back to a voltage that houses can use. Then power is delivered to consumers.

There are several ways we generate power. Coal, water, natural gas, nuclear, oil, and wind are all ways that we produce energy.

*Water:* Hydroelectric power is produced from moving water. Water can push a turbine in order to harness energy for consumption. Hydroelectric power relies on the water cycle. The amount of rain that drains into rivers and streams determines the amount of water available for producing energy.

*Coal:* Burning coal is another way to power our homes. Coal is the world's most abundant and cheapest fossil fuel but it also releases the most pollution into our atmosphere. Coal is found in China, India, and the United States.

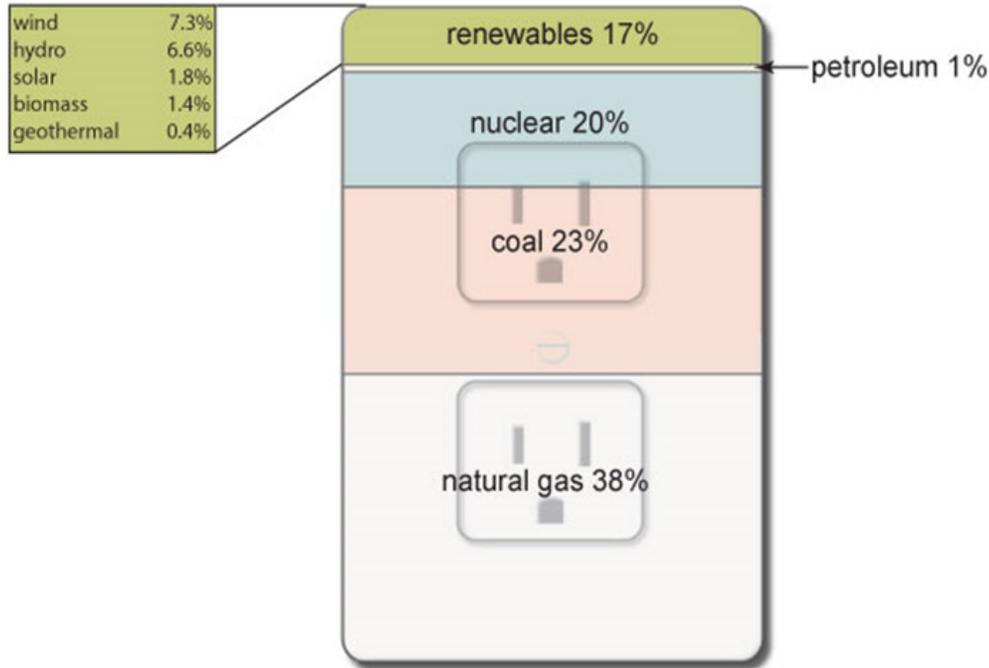
*Wind:* Wind power takes advantage of airflow to turn an electric generator. Although wind power is a variable power that depends on the weather, it is a stable source of energy over a long-term period. It is a reliable resource to meet power needs. One of the biggest downsides of wind energy is the noise and visual pollution. Wind turbines can be noisy when operating, expensive and wind is unpredictable.

*Natural Gas:* Natural gas provides around one-third of our energy and is used to heat about half the homes in the United States. Propane, which powers many kitchen stoves and outdoor grills as well as home heating systems, is derived from natural gas. Natural gas is also used to generate 38% of our electricity. Natural gas is often described as "clean burning" because it produces fewer undesirable by-products per unit energy than coal or petroleum.

*Nuclear:* Nuclear power is produced by harnessing a process called nuclear fission. Nuclear fission is breaking apart bunches of neutrons by splitting spontaneously or on impact with another particle, with the release of energy. This happens within a nuclear reactor. The power plant harnesses the energy from the split by using a cooling chamber that removes the heat from the reactor core. They do this by using a cooling system that generates steam, which powers a steam turbine. The turbine converts the steam to mechanical energy and then to electrical energy. Nuclear plants are expensive to build and accidents can and do happen.

## Sources of U.S. electricity generation, 2019

Total = 4.12 trillion kilowatthours



Note: Electricity generation from utility-scale facilities. Sum of percentages may not equal 100% because of independent rounding.

Source: U.S. Energy Information Administration, *Electric Power Monthly*, February 2020, preliminary data



Once created, electricity travels to a transformer that steps up the voltage for its long journey to consumers. There are 200,000 miles of high voltage transmission line and 5.5 million miles of lower voltage lines in the U.S. The voltage is stepped down before moving to local distribution lines, which carry the electricity to utility poles, where a transformer steps down the voltage again before it enters our homes and businesses.

### What Causes Power Outages?

Life changes when utility power fails. According to the Eaton Blackout Tracker, power outages can be driven by a number of causes. Storms, hurricanes and blizzards, fires or equipment failure can knock out the power to your home. The Eaton Blackout Tracker reported in 2018 that there were over 32,500 hours of recorded power outages. Weather and demand for power at peak hours can cause the majority of outages.

**High Winds:** Storms, tornadoes, blizzards, and hurricanes all have to possibility to damage property. High winds can pick up debris and fling it at buildings, homes, and power lines. It is easy for high winds to cause power loss to surrounding homes and businesses.

**Heatwaves and Hot Weather:** It is easy to imagine how much demand there is to fuel the army of A/C units in heatwaves. For the power plant, heat is a bigger issue. Hot weather makes energy

generation less efficient. When there is a high demand, it plays a big role in what causes power outages in summertime.

**Winter Storms:** Severe winter storms can cause all kinds of danger. Low visibility, frostbite, hypothermia, loss of electricity, and risk of elderly and young children's health contribute to the dangers of winter. Without power, pipes can freeze and heat quickly becomes a concern.

**Ice:** Power lines in winter may accumulate ice. When they do, ice forms in an upside down teardrop shape. The shape acts as a sail and makes the power lines sway in the wind. When the power lines sway, there is a possibility for them to make contact with each other and cause a fault or subsequent outage. In strong winds, the movement can also cause power line arms to break and the lines to fall to the ground.

Power outages are a consequence of more than just bad weather. In a report by Climate Central, while 78% of power outages in the U.S. are weather related, other causes include vehicle accidents, utility equipment failure, animals and an overworked power grid. In California, utilities have implemented Public Safety Power Shutoffs (PSPS) in an attempt to mitigate the risk of wildfires, instructing customers to prepare for proactive outages lasting several days.

## Why Are Power Outages Increasing In Frequency And Duration?

Power outages have become more prevalent and problematic in recent years, especially in an increasingly connected world. Peak energy demand is when electrical power is expected to be provided for a sustained period at a significantly higher than average supply level. When maximum supply levels are surpassed, power outages can happen. The U.S. Energy Information Agency (EIA) notes extreme weather events have escalated, putting pressure on the aging and vulnerable grid.

## What Is A Planned Power Outage?

Your utility provider will sometimes interrupt service temporarily to maintain the electric systems that serve you. The maintenance helps keep your lights on and enables safe and reliable service. Planned power outages give end users some notice, but not always enough. Most users have not been fully aware of the impact or the associated costs of power outages. Recently, due to maintenance challenges and increasing wildfire risks, Pacific Gas & Electric (PG&E) have implemented PSPS, meaning extended planned power outages are happening more frequently.

## What Is The Difference Between A Blackout And Brownout?

A brownout is a partial, temporary reduction in total system capacity, while a blackout is a complete interruption in power. Blackouts usually occur without warning and last for an undetermined period of time. During brownouts, the impact can extend beyond dimming lights. Critical equipment may be disrupted or go offline completely. A brownout can also be used by the utility to prevent the system from a blackout.

## How Do Fires Start From Power Lines?

Strong winds can lead to fires from power lines. They can topple over trees, or their branches, and pull down power lines, causing them to arc and spark dry vegetation. A voltage surge in the line can also cause it to arc to a nearby tree and start a fire. Aging wooden transmission poles are also susceptible to toppling over during high winds, further increasing fire risk. In dry vegetation, fires are easily triggered and spread quickly, placing (or putting?) communities in severe danger.

Replacing overhead lines to underground lines is helping to reduce the amount of fires. However, the process is expensive and timely. Until the transition can be completed, to prevent fires, it is important to work more aggressively to keep trees and branches as far away from power lines as possible.

## How Do You Prevent Power Outages?

While a long-term solution to outages has not been determined, utility customers need to start planning now for the next power outage event. Every user should assess their needs and potential impacts. If the user chooses to add power by generation or storage, it needs to coordinate with utilities and “users for spaces” (not sure with this means. Perhaps rephrase to “and power output needs”?). Portable backup power systems can be provided to businesses on short notice, but they do require partnering with an authorized provider, ensuring there is enough fuel and that the connection is made properly.

Each business has a particular need that is unique, and there are several options to choose between when selecting a type of generator. Most times, businesses require a custom solution. Generac offers an extensive product line from 15 kW through 3.25 MW single generators and as much as 100 MW through our Modular Power Systems (MPS). You can also choose to have a stationary unit or a mobile unit. Customers have a choice from larger alternators, sound attenuated enclosures, extreme performance enclosures, a variety of control systems and different size base tanks with trained experts on staff to simplify the experience every step of the way. Each system is designed to meet a business’s specifications seamlessly. An approved Generac dealer can help determine what solution is best for you.

Whichever type of generator you choose, it is important to consult an electrician to ensure proper selection and installation. A professional electrician can also help identify your town or municipal requirements for proper location on your property, noise restrictions and obtaining permits.

For a business owner, there are big benefits to getting a backup power system. You’ll save money and it can help employees get more done. A backup power system could pay for itself after one outage for answers to all your power outage questions and more, download our Power Outage fact sheet and start preparing your business today.

### References:

2018 Eaton Blackout Tracker: <http://powerquality.eaton.com/countries.asp?cx=-999>

Blackout: Extreme Weather, Climate Change and Power Outages, Alyson Kenward, PhD, and Urooj Raja, Climate Central: <https://assets.climatecentral.org/pdfs/PowerOutages.pdf>

Energy Information Administration: <https://www.eia.gov/todayinenergy/detail.php?id=43915>