

Before You Buy a Black Box



A black box is a device or system with external wires and claims it can do something. In many cases, what's inside the box is a mystery.

Many devices and systems in the market claim to improve the power quality or reliability of electric service. Some devices also claim to save energy. Often the technological claims are not clear or have not been verified in accordance with industry standards.

There are different types of power quality equipment available which have specific applications and are designed to work for that particular application in a defined environment.

To resolve a problem, first identify the cause.

Before investing in power quality mitigation equipment, be sure the cause of the problem is clear. Some common sources of power quality problems include: wiring and grounding, voltage or current imbalances, flicker, or noise. Check with your utility's power quality department for help or visit PG&E's web site at pge.com/powerquality for information on power quality.

What's real?

Some devices claim to do more than one thing. Be sure the device meets your needs.

Look at the data

Some devices claim that they can do multiple functions. Buyer beware! Be sure to read the fine print.

If data is available, check testing methods, conditions, and instrumentation. Some items may not have data to support their claims. Although electrical power production and delivery is a very mature industry, there are occasional breakthroughs. A new or novel device may do what is claimed. Do the research to ensure that the product will deliver the expected results.

Claims of energy savings

Some devices may save energy. Validate this either through short term testing with the device online or long term in a controlled laboratory environment at a certified laboratory in accordance with industry standards.

Be wary of guaranteed energy savings. Energy savings can be very difficult to prove especially when load and usage fluctuate. Also a guarantee is only as strong as the company behind it and may have exceptions where the guarantee does not apply.

Some devices filter out harmonics. Harmonics can distort your power and cause problems for your equipment. Reducing harmonics may improve your power factor and reduce line losses. However, these savings are small and hard to calculate.

Some devices with a simple voltage reduction technique can save energy but have limited application since there is usually a reduction in output such as lower lighting levels or less shaft horsepower. These devices typically chop the voltage sine wave to achieve a voltage reduction.

Other devices reduce reactive power but not watts. Since customers pay for watts or kilowatt-hours, there may be little or no dollar savings. Reducing reactive power also helps to improve power factor. Some utilities do penalize for poor power factor. Sometimes, it also depends on your rate schedule, so check for your particular case.

Check with your local utility for energy efficiency programs and possible rebates for energy efficient equipment. However, please be aware that power conditioning and power correction equipment are not currently eligible for PG&E's Rebate Program.

Things that work

In general, the devices mentioned below have been demonstrated over time to work as intended. Obtain these devices from a reputable manufacturer. The most common power quality mitigation devices are listed below. More information is available in a series of Power Notes at [power quality notes](#).

- **Transient Voltage Surge Suppressors (TVSS)**

TVSS, sometimes known as Surge Protection Devices (SPD), may protect equipment from some surges if the right device is chosen for the right application. (See Power Note regarding "[Surge Suppressors](#).")

However, the Federal Trade Commission has challenged claims that surge protection products provide significant savings. According to the California Energy Commission, some recent studies have found that the presence of transient voltage does not appreciably increase energy consumption. This suggests that surge protection devices may not provide appreciable energy savings. Also, an earlier study by the Electric Power Research Institute has also concluded that the devices do not save energy.

- **Harmonic Filters**

Both active and passive filters can reduce harmonic distortion. However, the application of a harmonic filter is very complex and requires a professional engineer to design the system. The most effective harmonic filters are designed for a specific harmonic that is creating the problem. (See Power Note regarding "[Power System Harmonics](#).")

- **Power Factor Correction Capacitors**

Correctly applied capacitors may improve power factor. To avoid overcorrection, a system design approach is necessary. Using a capacitor can provide the reactive power required by motors. This will reduce active current and line losses. (See Power Note regarding "[Economics of Power Factor Correction](#).")

- **Constant Voltage Transformer**

Constant voltage and ferro-resonant transformers can maintain a constant voltage output with a variable voltage input. However, they have limitations depending on the load, the duration, and the magnitude of the voltage variation. (See two Power Notes, "[Short Duration Voltage Sags](#)" and "[Voltage Sag Ride through Mitigation](#).")

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- ***Uninterruptible Power Supply (UPS)***

A UPS can help ride through a voltage sag or power interruption for a limited time period. A UPS can be expensive for a large application. In some instances, alternatives are available. (See Power Note regarding "[Uninterruptible Power Supply.](#)")

- ***Power Conditioners***

Some manufacturers market their devices as power conditioners, which can do one or more of the applications listed above. It is important to know what the device does and whether it meets your need.

For additional information, please visit the California Energy Commission web site at energy.ca.gov/project-reports.

The document entitled "*Power Quality Guidelines for Energy Efficient Device Application*" is a guidebook with three primary objectives.

1. To provide guidelines for minimizing any undesirable power quality impacts of energy saving technologies.
2. To provide an understanding of the energy savings potential of power quality related technologies.
3. To provide guidelines for evaluating "black box" technologies.

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