PACIFIC VOLT
INTELLIGENT VOLTAGE CONTROL

Why Voltage is a Variable Expense that should be Managed

If you are like most people, the extent of your knowledge about electricity is you either have it or you don't. When you don't have electricity, the voltage is zero. When you have it, the voltage should average around 120 volts. However, in between those two extremes, imperceptible differences in your voltage affect your electricity bill.

This is not common knowledge, in fact, if you ask your local utility representative they will most likely tell you it does not make any difference. They are not trying to mislead you. It's just that they don't have any way of controlling the voltage to individual customers. So, they won't pay any attention to it as long as it's within their allowable range. In the USA the allowable voltage delivery range is 114 V to 126 V. Voltage rises and falls on a daily cycle. For most customers, the average voltage over a day is between 120 and 121 volts. Customers close to the substation will have higher average voltage, and customers at the end of line will have lower voltage. This is just the physics of the way electricity works.

If you had two identical convenience stores, one near the utility substation (high voltage) and one at the end of a feeder line (low voltage); the energy charges for the store near the substation would typically be 6-10% higher than the other store - even with identical business. Managing your voltage will save you money. Considering that electricity is usually the second highest expense for a convenience store operation, voltage represents a variable expense that should be managed.

Why does this happen? Without getting too technical, it basically boils down to the fact that losses in electrical devices are largely proportional to the voltage squared. As an electrical appliance converts electricity into light or some form of work, some percentage of the total energy is lost in the conversion process causing the device to heat up. Higher voltage increases these conversion losses, which is converted into waste heat, which increases your bill.

Why is extra heat a problem? The primary issue in addition to higher costs, is that the additional heat decreases the life of your equipment. A rule of thumb in engineering is that whenever you raise the operating temperature of an electrical device 10°C, you cut the lifetime of that equipment in half. Small motors common to convenience stores, will typically increase their operating temperature by 8°C when the voltage increases from 114 to 126V. The higher the voltage, the higher the maintenance costs. Secondarily, in the summer the extra waste heat increases your air conditioning load. In the winter it may appear to be beneficial, however other forms of space heating are more cost effective than resistive electric heat, and they don't reduce the operating life of your equipment.

How can voltage be managed? There is a new kind of voltage regulator, which has unique qualities making it perfect for this application. Pacific Volt's core business is selling into the utility market, so this is not another black box technology. It is a high efficiency, precision voltage regulator. For 120 V systems, the ideal voltage is 114 Volts as long as the voltage is dynamically regulated and held precisely at 114. The standard for utility voltage delivery in North America is 114 V up to 126 V.

Many electricians will tell you that 114 V is too low. This is because they know the utility voltage changes significantly throughout the day. If your utility voltage averages 114, that means sometimes the voltage would be higher and sometimes it would be too low; which will damage your equipment. However, this is a distinctly different situation than having a dynamically regulated voltage held constant at 114 V.

What else happens when you regulate utility voltage? Pacific Volt voltage regulators balance the voltage of each phase independently in three-phase power systems. This optimizes three-phase motor efficiency and their usable life. Pacific Volt regulators also provide transient protection, which protects internal loads from quick high voltage spikes. Another advantage is process control. Voltage sensitive equipment, such as slushy dispensers will put out a consistent product because the voltage is not fluctuating throughout the day.

If this is a good idea, why isn't it common practice? Obviously, voltage regulators have been around a long time in one form or another. Most voltage regulation technologies lose 3-6% of the energy that goes through them, making them impractical for this application. Other voltage regulation technologies are efficient; however, they distort the voltage sine wave. This is not good for your equipment or the utility.

Advances in technology and optimization of the design have allowed Pacific Volt to produce a voltage regulator, which averages less than 1% losses. Not only is the Pacific Volt regulator efficient; it has fast response, high accuracy, and no voltage distortion. It is ideally suited for improving power quality and the electrical efficiency of convenience stores, and small to mid-sized grocery stores. Below is the power histogram of a convenience store showing the load profile shifting towards zero with regulation (green) compared to unregulated (red).