

Reducing your Electric Bill, Part 2: Power Factor Correction

How to Save Money by Managing the Penalty Portion of your Electric Bill



Electric current flowing through a conductor, such as a wire, creates a magnetic field around the conductor.

Alternating current causes the magnetic field to build up and collapse each half cycle. As the current cycles to zero, the magnetic field collapses and energy stored in the field is sent back to the power company. This current shuttling back and forth to the power company called reactive energy, does no useful work. It doesn't turn the watt-hour meter either, so you don't pay for it.

The current that does useful work, such as turning a motor, is called active current, and it turns your meter. It is the energy part of your electric bill. Unfortunately, the motors won't turn without the magnetism being created, so the reactive current can't be eliminated. These currents are out of phase with each other, so they can be measured only through vector addition.

Power factor is the ratio of active power to total power. To calculate power factor, divide active power by total power.

Power Factor Cost

Assume that your power factor is 0.8. You pay for 4 amps of power, but the power company must build its generation plants and transmission lines and size its substations and local transformers to carry the total current, which is 5 amps.

The power company covers the cost of paying for moving this reactive current back and forth by adding a power factor penalty clause to your bill. The more total power your plant requires compared to the active portion you pay for, the higher the penalty clause.

How to Control It

The best way to reduce or eliminate a power factor penalty is to add capacitors. These are local "storage tanks" for reactive power. When the motor magnetic field collapses, reactive power is sent to any capacitors in the vicinity for temporary storage until the motor needs it. The required magnetizing current never leaves your facility.

Since the power company no longer has to handle this reactive current, there is no penalty clause. Your savings almost always will pay for the capacitors quickly if you have a power factor penalty clause in your power contract or if you are billed on a KVA basis rather than a KW basis. Payback is typically 18-30 months.

Good places to install capacitors include:

- The main switchboard.
- The motor control center.
- The motor starter, either after the contactor but ahead of the heater block or after the complete starter where the motor leads connect.
- The motor at or near the motor junction box.

This article is the second in a series based on a presentation by Darrel Ramhorst, P.E. It appeared in the July/August issue of GJ (Grain Journal) and is reprinted here with the permission from the publisher.

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