

The New Reactive-Power Charge and Mandatory Hourly Pricing

What You Need to Know Now, and Why

How to Calculate Your Savings and Payback Period

Before deciding what investments will best improve the power factor of your equipment, you should calculate the savings and payback period. Be sure to consult the engineering professionals on your staff or a professional engineer or electrical consultant when calculating savings and payback periods.

Let's say the charge for reactive power is \$1.10 per kVAr. You install a 200-kVAr capacitor in a facility with the following characteristics:

- 208 V, three-phase service
- 250 kW real power average load
- 500 kW real power peak load
- Seasonal load variation:
 - 100% of peak (June through September, inclusive)
 - 80% of peak (October through May, inclusive) = 400 kW
- Uncorrected power factor is 70% at peak load
 - 510 kVAr (June through September, inclusive)
 - 408 kVAr (October through May, inclusive)
- Internal energy loss is 2%

For your business' summer-peak month, you pay \$1.10 per kVAr up to a power factor of 95%. If your equipment has a power factor of 70%, you will consume 510 kVAr and pay for 347 kVAr ($510 - 163 = 347$ kVAr, the amount of kVAr from 95% to 100%). So, your monthly cost for reactive power is \$382.

You install 200 kVAr of capacitance and that reduces the peak reactive power (510-200 kVAr) to 310 kVAr and raises your equipment's power factor to 85%. As a result, you will only pay for 147 kVAr for a monthly cost of \$162.

If the cost to install capacitors to correct the power factor is \$15,000, the savings and payback period can be calculated as follows:

1. To calculate the new power factor, use the following equation to find apparent power

$$\begin{aligned} \text{kVA} &= \sqrt{\text{kW}^2 + \text{kVAr}^2} \\ \text{kVA} &= \sqrt{500^2 + 310^2} = 588 \text{ kVA} \end{aligned}$$

2. Use the following equation to find the corrected power factor.

$$\begin{aligned} \text{PF} &= \text{kW}/\text{kVA} \\ \text{PF} &= 500/588 \\ \text{Corrected power factor} &= 85\% \end{aligned}$$



With the corrected power factor, the new peak reactive power is:

310 kVAr (June through September, inclusive)

408 kVAr – 200 kVAr = 208 kVAr (October through May, inclusive)

3. Use the following equation to determine the reduction in energy losses.

1- (Original PF²/new PF²)

1- (0.70²/0.85²) = 32%

Since the energy loss before the correction was 2% of the real power:

250 kW x .02 x .32 = 1.6 kWhr energy saved

Now the expected savings from the investment can be calculated:

Total Annual Reduction in Reactive Power Charge

200 kVAr x \$1.10 per kVAr x 12 billing periods per year = \$2,640

Energy Cost Savings

1.6 kW x 8,760 (hours/year) x \$.12/kWh = \$1,682, which is also equivalent to 34 tons of carbon emissions

\$2,640 + \$1,682 = \$4,322

Simple Payback Period

\$15,000/\$4,322 per year = 3.5 years



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