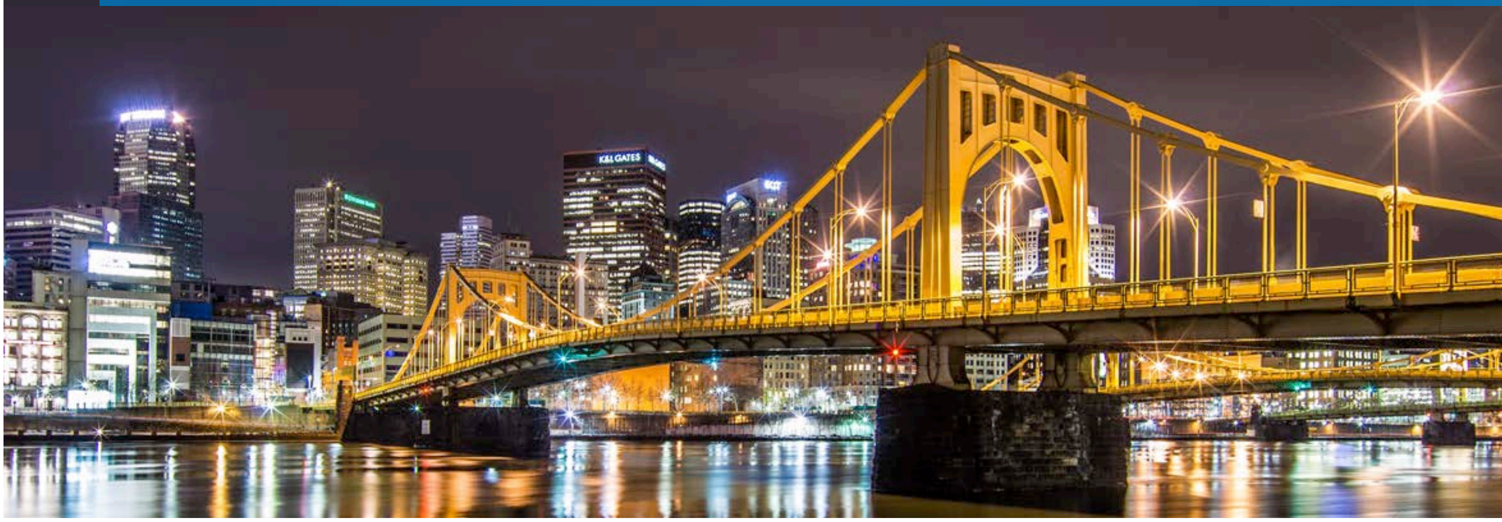
Customer Success Story:
Power factor correction



Avoid the hidden surcharge

Eaton helps a commercial office building improve the efficiency of its electrical system through power factor correction to achieve a big utility savings and fast ROI

Location:
Pittsburgh, Pennsylvania

Segment:
Commercial office building

Challenge:
Improve electrical system efficiency to eliminate power factor penalty and generate substantial savings on electric utility bill.

Solution:
Utility bill analysis and power factor correction study led to the sizing and installation of fixed capacitor banks to correct the system's power factor.

Results:
The facility was paying a power factor penalty of $1,932 per month. A power factor capacitor bank was purchased from and installed by Eaton for $12,000, resulting in a payback of just over 6 months.

"Adding Eaton power factor correction equipment to support the HVAC and elevator loads in this commercial building increased its average power factor from 0.86 to 0.95, saving the company nearly $24,000 per year on their electric bill."

Background

The owner of a large commercial building in Pittsburgh, Pennsylvania, was looking for ways to improve the efficiency of its electrical usage to help meet some of the company's green objectives and save money on utility bills. Eaton was brought in to assist with this initiative and was able to inform the user that their local electric utility charged a penalty to all customers with a three-phase electrical service, like the one in this building and others like it, for having a power factor of less than 0.95. Adding power factor correction capacitors would reduce the customer's current draw from the electrical grid and help them with the green initiative. Because this particular utility charges for the type of current that results in poor power usage, implementing a power factor correction solution would save the customer money each month on the utility bill.

Most electric utilities include demand charges in their rate structures for all non-residential customers. A demand charge is based on the maximum amount of electricity consumed during peak periods and is billed even when consumption is below peak. The demand charge can be measured in various units, most commonly kVA demand, kW demand and kW demand with a power factor kvar penalty below a specified value. Reactive current is kvar or vars consumed by inductive loads, like motors, to generate magnetic fields. While reactive current does not do the work, like that being consumed for watts or kW, there is a cost for electrical utilities to generate and transmit this current. Power factor measures how effectively power is being used. Utilities track this number and penalize customers with a poor power factor to create an incentive for customers to improve their system to lessen their utility demand, improve energy usage and reduce waste.

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To determine power factor (PF), the utility looks at the ratio of "working" power measured in kilowatts (kW) to apparent power, measured in kilovolt-amperes (kVA), which is the total power capacity. Kilovolt-amperes include both kW and kilovolt-amperes-reactive (kvar). The more kvars that make up a facility's kVA, the less inefficient they are at consuming power. For example, at 70% power factor, it would require 142 kVA to produce 100 kW. At 95% power factor, it requires only 105 kVA to produce 100 kW. Therefore, the utility can reduce waste and produce less energy to meet demand when its customers maintain a high power factor. The improved power factor reduces the overall customer demand charges, which in this case is the power factor penalty.

Challenge

Power factor correction (PFC) solutions are often determined through power factor and harmonic studies, which can be quite costly to undertake. These studies, as part of designing a solution for a large industrial facility, can easily be incorporated into equipment and installation costs while providing the necessary return on investment (ROI). For smaller commercial facilities, these studies can be cost prohibitive, but the penalties they are incurring still represent a significant portion of their monthly utility bill. Eaton must determine the correct solution without conducting an expensive system analysis.

Solution

The review of a customer's utility bills over a full year will provide a good profile of the customer's electrical usage during different loading conditions and at different times of the year. When installing power factor equipment, it is important to take note of the other equipment that is on-site to ensure there will be no negative interactions with the PFC equipment. Eaton's knowledgeable local sales staff was able to perform a walkthrough of the Pittsburgh facility to gather the important information, such as the transformer size and the quantity and size of any nonlinear loads that could affect the PFC bank.

Using the site information, utility bills and knowledge of the utility's rate structure, Eaton's experienced team was able to determine the customer's current power factor range and size a capacitor bank that worked with their electrical system's requirements and met the utility's correction criteria.

Results

After installing the Eaton power factor correction unit to their system, the customer's power factor improved from 0.86 to over 0.95. This saved the customer nearly $2,000 per month on their electric utility bill. In addition to avoiding the penalty, the PFC bank reduced the customer's energy draw from the utility grid, thus meeting their company's green initiative goal by operating their electrical system more efficiently.

Facility profile:

1500 kVA transformer
1146 kW demand
PF range: 0.86 to 0.88
Low number of harmonic loads

Utility charges:

Penalty below 0.95 PF with no charge for over correction
$12/kW demand charge
PF penalty multiplier = 1.14
1307 kW (billed) – 1146 kW (actual) = 161 kW (penalty)

Capacitor bank selection and ROI:

Fixed unfiltered bank cost with installation approximately $12,000
Penalty based on cost of 161 kW = $12 x 161 kW = $1,932/month
Payback period = $12,000/$1,932 = 6.2 months

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