E-Notes

Energy Efficiency Notes

Reducing Electricity Demand Using Power Factor Correction

Background

Power factor correction is the addition of capacitors to electrical loads to reduce the electrical current drawn from the electrical power system. In commercial, industrial, or recreational facilities that have a number of electric motors or other types of non-heating electrical loads, power factor correction can usually be economically attractive.

In Saskatchewan, as in most places in the world, commercial and industrial customers who consume more than a certain amount of kilovolt-amps have to pay a demand charge (based on the peak electrical demand in kilo-volt amps) for electricity in addition to the charge for the electrical energy consumed. In Saskatchewan, the threshold is 50 kilovolt-amps. If, in a given month, the peak electrical demand as measured by the electrical meter is greater than 50 kilovolt-amps, the customer will pay a demand charge.

Customers can tell if they pay demand charges by observing their monthly electrical bill. Another way to determine if demand is being charged is to observe the electrical meter. A sketch of an electrical demand meter is shown in figure 1.

Figure 1. Front face of an analog electrical demand meter
(Diagram courtesy of SaskPower)

The pointers on the demand register of the meter indicate the current value of the electrical demand (Red pointer) and the peak value of the electrical demand (Black pointer). Newer facilities sometimes will have demand meters with digital displays.

Power factor correction is desirable for the following reasons:

1. Poor power factor results in higher losses in cables and transformers, and thus higher energy bills for a given amount of useful work output.
2. With poor power factor, there is reduced available capacity of transformers, circuit breakers,

and cables, whose capacity depends on the available current. The capacity falls in direct proportion as the power factor decreases. Thus a 100 kilovolt amp transformer connected to a load with a 75 % power factor would be able to supply 75 kilowatts. If the power factor of the load is increased to 95%, the same transformer can supply 95 kilowatts.

3. With poor power factor, the amperage loads must be higher in the cables supplying the loads. With higher amperages, the voltage drop is greater in the cables, and some loads such as motors may have problems with undervoltage.

Savings from power factor correction

Power Factor Correction is usually cost-effective under the following circumstances.

1. The monthly peak demand of the facility exceeds 50 kilo-volt amps..
2. The facility has a demand meter.

Typical payback periods are in the range of 1 to 3 years for many applications.

Points to watch

1. The sizing of power factor correction equipment is a job for professionals. Factors such as electrical demand rates, months of use, the selection of automated or non-automated PFC equipment are among the factors that should be taken into acccount when sizing the power factor correction installation.
2. Power factor correction equipment can be installed in several locations. One common location for large single loads like electrical motors is at the motor panel. In situations where there are no large single loads which dominate, the power factor correction equipment is often installed at the main breakers for the facility.
3. Automated power factor correction equipment is available for automatically adjusting the power factor.
4. Harmonic currents can occur in some installations. Capacitor reactors or filter ban equipment may be required.

Availability

For design of PFC systems, most electrical engineering firms have specialists.
Companies that provide power factor correction equipment are listed in the Saskatoon and Regina telephone books under Electric Equipment Mfrs.
A western Canadian manufacturer of power factor correction equipment is Electrotek Ltd., 1016 34 Ave. SE, Calgary, T2G 1V4, Phone 403 287 2200, Fax 403 287 3808

References

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