

## The Fallacy of Cost per Kvar

Northeast Power Systems, Inc. (NEPSI) is often asked to provide cost per kvar (ratio) information to potential customers of power factor correction equipment. Individuals asking for this information typically would like to be able to quickly calculate cost, paybacks, and compare potential suppliers. NEPSI has found that it is difficult to provide this ratio for Metal-Enclosed Capacitor Banks and Harmonic Filter Banks and that its use can lead to incorrect results and budgeting errors. This technical note provides information as to why metal-enclosed capacitor banks and harmonic filter bank cost cannot be simplified to a simple cost per kvar ratio and how you can quickly obtain cost per kvar.

The ratio of cost per square foot is often used in the real estate market as general indicator of the market value of a house. While it would be convenient and straightforward to purchase a house solely based on cost per square foot, this is not practical. Many factors influence the value of a house other than square footage. Factors such as location, property taxes, the number of bathrooms and bedrooms, fireplaces, school district, etc. all influence the value of a house. That is why in real estate, market value for residential real estate is determined almost entirely by looking at "comps" or comparable sales of similar homes.

In a similar manner, when evaluating or comparing power factor correction equipment, especially at the medium voltage level, cost per kvar is not practical unless the equipment being compared is identical in features and options and/or complies with the same equipment specification. As discussed below, cost per kvar is not linear and is highly dependent on the specific application and varies greatly with equipment features.

### Factors Affecting Cost per Kvar

Factors that contribute greatly to the cost per kvar are:

- Voltage level of bank. Generally the voltage class (i.e. 5kV, 15kV, 38kV) of the equipment greatly influences component cost within the bank, and therefore has an effect on the overall cost per kvar.
- Number of switched stages. As the number of switches stages increase, the cost per kvar increases due to the cost of the switches and controls to operate the switches.
- Control requirements. The addition of controls increases the cost per kvar.
- Filter bank rating requirements and tuning point.
- Individual Capacitor kvar rating.

Figure 1 shows how the cost per kvar for the capacitor alone (no other components) can change from near \$10 per kvar for a 50-kvar two bushing capacitor, to near \$2 per kvar for a 500-kvar capacitor two bushing capacitor. It should therefore be simple to see how the components shown in Table 1 can further complicate the over-simplified ratio of cost per kvar.

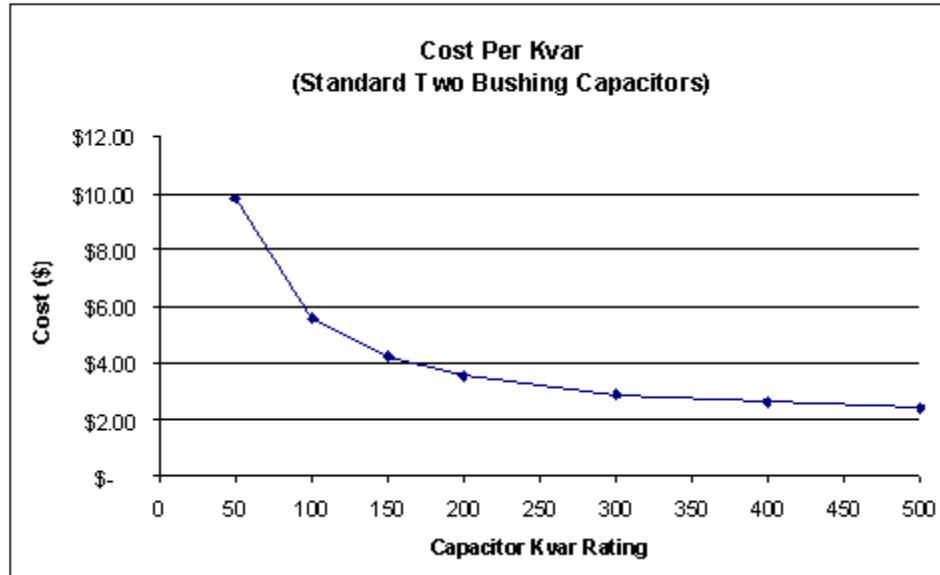


Figure 1 - Cost Per Kvar for Standard Two Bushing Capacitors

Table 1 - Typical Components of a Metal-Enclosed Capacitor Bank or Harmonic Filter Bank

<i>Table 1 - Typical Components of a Metal-Enclosed Capacitor Bank or Harmonic Filter Bank</i>		
Vacuum Switch	Ground Switch	Control Power Transformer
Air Disconnect Switch	Current Limiting Fuses for Capacitor Protection	Current limiting fuses for protection of entire bank
Filter Reactors	Enclosure	Protection Relays
Automatic Controls	Strip Heaters	Exhaust Fans
Transient Inrush Reactors	Lights	Metering

### A Better Approach

When attempting to evaluate, compare, or cost justify power factor correction equipment, the best approach is to request a formal quotation for your specific application. Northeast Power System, Inc. can quickly provide a detailed quotation, the same day or the next day, which indicates standard features and costs for optional accessories. If you are not sure what features and options should be included for your application, one of our applications engineers can assist in developing a specification for your application. Detailed guide form specifications are available for metal-enclosed filter banks and capacitor banks that can serve as a template.

### Conclusion

In theory, cost per kvar information for power factor correction equipment can be used to determine payback periods and evaluate potential suppliers. However, from a

practical standpoint, many factors effect cost per kvar, and unless similar equipment with similar rating with the same features and options is being evaluated, the information is misleading.

Northeast Power Systems, Inc.  
66 Carey Road  
Queensbury, New York 12804  
Phone: 518-792-4776  
Fax: 518-792-5767  
E-mail: [sales@nepsi.com](mailto:sales@nepsi.com)  
Website: [www.nepsi.com](http://www.nepsi.com)

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